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Museum



Fig. 1. *Iguana iguana iguana* (M.C.Z. No. 12144, Water Island).

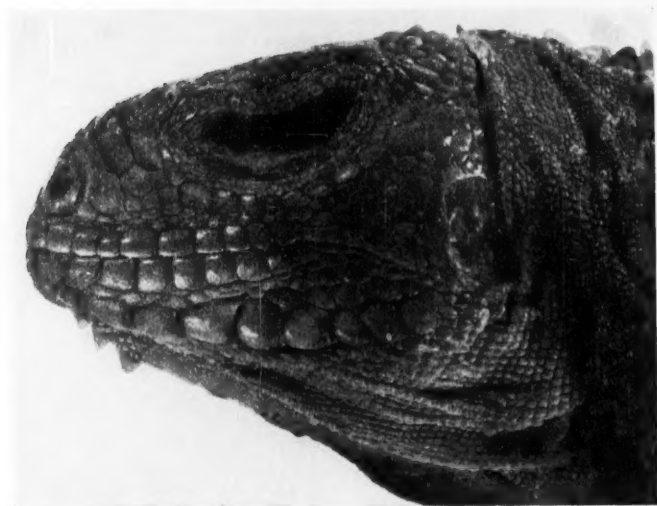


Fig. 2. *Iguana delicatissima* (M.C.Z. No. 10975, Terre d'en Haut).



Notes on *Iguana*

By E. R. DUNN

THE genus *Iguana* seems to contain three recognizable forms: *iguana* Linné 1758 (Syst. Nat., ed. 10: 206; type locality "Indiis"), *delicatissima* Laurenti 1869 (Syn. Rept.: 48; type locality "Indiis"), and *rhinolopha* Wiegmann 1834 (Herp. Mex.: 44; type locality "Mexico").

The differences between *iguana* and *rhinolopha* consist chiefly if not entirely in the possession by the latter of a median row of horns or tubercles on the snout, which are lacking in *iguana*. These are not correlated with sex; and while better developed, as a rule, in adults, are quite recognizable, when present, in very young specimens. The geographical position of these forms on the mainland, the fact that individuals exist which cannot be surely allocated, and the fact that such dubious individuals occur in the debatable ground between the ranges on the mainland, makes it necessary to consider that the two are races of a single species. All the specimens that I have seen from north of Nicaragua and all but one from Nicaragua have horns, and I have seen no specimens from South America that have them. Three from the Pacific coast of Costa Rica lack horns, two from the Atlantic side have them. The British Museum has a somewhat horned specimen from "Panamá," and a specimen from "Nicaragua" which "shows tendencies" towards horns. The United States National Museum has a large specimen from Tabernilla, Panamá, and another large specimen from "Nicaragua" which are indistinguishable. Both have a slightly developed median row of tubercles on the snout. The mainland situation seems to me a plain case of racial differences, and I think specimens from Panamá and the Atlantic side of Costa Rica should be called *Iguana iguana iguana*, and Nicaraguan and Pacific side Costa Rican specimens should be called *Iguana iguana rhinolopha*. Specimens from islands adjacent to the mainland reflect the mainland situation.

It is in the Antillean and Caribbean islands remote from the mainland that the situation becomes difficult.

In the first place there are a fair number of records of *i. rhinolopha* in the literature from Hispaniola. These are all old records and may fairly be said to indicate *Cyclura cornuta*.

In the second place there is another species of *Iguana* in the Lesser Antilles, and there is no question of possible intergradation. In *iguana* there is an enormous subtympenic scale, which is lacking in *delicatissima*, while *delicatissima* has a series of very large scales paralleling the lower labials, and *iguana* has the throat scales relatively uniform. These differences are shown quite well by the photographs, which I owe to the kindness of Mr. Clinton McCoy.

There is one record of *delicatissima* from the mainland. Cuvier (1829, Regne Animal, ed. 2, 2: 45) describes *I. nudicollis*, a synonym of *I. delicatissima*, from Brazil and Guadeloupe. In over a hundred years no specimen has appeared to confirm this solitary mainland record. I think it should be somewhat discounted.

¹ Contributions from the Department of Biology, Haverford College, No. 20.

There follows a list of islands remote from the mainland, from which I have seen *Iguana* specimens or from which the genus has been reported. Records based on specimens I have seen will *not* be cited. Records based on specimens I have not seen will be cited *if* they disagree with, or add to, the information derived from specimens I have seen. I have tried to be careful to use only reports made by persons who examined the original specimens.

No iguanas at all are *known* from the Greater Antilles.

Iguana iguana iguana is widespread on the islands which rise from the Virgin Island bank, as the following reports show:

St. Thomas (A. N. S., Swift; M. C. Z., Garman, 1879; U. S. N. M., Shoemaker, 1915; A. M. N. H., Anthony and Godwin, 1926).

Water Id., near St. Thomas (M. C. Z., Peters, 1917; Grant, 1933).

Hassell Id., near St. Thomas (Grant, 1932, Journ. Dept. Agric. Porto Rico, 16, 3: 341).

Tortola (Reinhardt and Luetken, 1862, Vid. Medd.: 245, as *I. tuberculata*, a synonym of *i. iguana*, specimens in Copenhagen).

Peter Id., near Tortola (Grant, *l.c.*).

Guana Id., near Tortola (Grant, *l.c.*).

St. John (Reinhardt and Luetken, *l.c.*, specimens in Copenhagen).

From the isolated island of St. Croix I have seen *Iguana i. iguana* (A. N. S., Davidson).

From the isolated island of Saba I have seen *Iguana i. iguana* (M. C. Z., Lagois).

The islands on the Anguilla bank support *Iguana delicatissima*.

Anguilla (M. C. Z., Peters, 1922).

St. Martins (A. N. S., Rijgersma).

St. Bartholomew (M. C. Z., Lagois).

On the St. Eustatius bank there is the following situation:

St. Eustatius (*delicatissima*, M. C. Z., Peters, 1922).

St. Kitts (*I. rhinolopha*, Gray, 1844, Cat. Rept. Brit. Mus.: 186; a halfgrown specimen presented by Gray himself, and apparently no longer in the British Museum, since Boulenger in 1885 does not mention it in his Catalogue).

Nevis (*delicatissima*, M. C. Z., Lagois).

Guadeloupe and the nearby islands support the following iguanas: Guadeloupe (*delicatissima*, U. S. N. M., Guesde, 1881).

Terre d'en Haut, Isles des Saintes (*delicatissima*, M. C. Z., Noble, 1914).

Cabrit, Isles des Saintes (*i. iguana*, M. C. Z., Noble, 1914).

From Dominica *i. iguana* has been reported (Boulenger, 1885, Cat. Liz. Brit. Mus., ed. 2, 2: 190; a halfgrown female, no collector mentioned).

From Martinique *tuberculata* and *delicatissima* are both reported (Duméril and Bibron, 1837, Erp. Gen., 4: 206; specimens in Paris).

From Santa Lucia *i. rhinolopha* is reported (M. C. and M. A. Duméril, 1851, Cat. Rept. Mus. Paris: 63; specimens in Paris; and Boulenger, 1885, *l.c.*: 191; a stuffed adult, no collector mentioned).

Grenada has *I. i. iguana* (M. C. Z., Garman, 1879).

Tobago has *I. i. iguana* (M. C. Z., Clark, 1916).

The genus *Iguana* is also known or reported from the following islands in the Caribbean:

Cayman Id. (*delicatissima*, M. C. Z., Brown, 1911).

Swan Id. (*nudicollis* reported by Cope, 1869, Proc. Amer. Philos. Soc.: 159; specimen in Columbia College, N.Y.). I have seen five *I. i. rhinolopha* and four *I. i. iguana* from Swan Id.

The distribution of *Iguana* in the Lesser Antilles, from specimens I have examined, is: *I. i. iguana* on the Virgins, St. Croix and Saba; *I. delicatissima* from Anguilla to Isles des Saintes; *I. i. iguana* from Isles des Saintes to South America. The specimens I have seen from the Lesser Antilles thus exhibit a quite definite distribution, despite the facts that the animals are an article of commerce, and are very able swimmers. I think that the data indicate *delicatissima* as endemic in this area. Whether *i. iguana* has been transported to the Virgins by human agency, across the area of *delicatissima*, or whether *delicatissima* has differentiated in the middle of an area of *i. iguana*, while the two extremes remained in the original state, is, of course a problem, although I think the latter hypothesis the more probable.

The reports of *i. iguana* from Dominica and of both *i. iguana* and *delicatissima* from Martinique, may mean that the two species overlap more than the certain fact that both occur in the Isles des Saintes would indicate. I have not seen the specimens.

The reports of *i. rhinolopha* from St. Kitts and from Sta. Lucia are very strange. Accidental or human transportation from Central America to these two islands would seem very unlikely. St. Kitts *should* have *delicatissima*, as its situation on the same bank with, and between St. Eustatius and Nevis, both of which are known to have *delicatissima*, makes obvious. The record is very dubious and the specimen seems to have disappeared. Sta. Lucia *should* have *i. iguana*. Possibly the horned mutation has appeared independently in that island. No recent specimens are known.

Garman reported on the Cayman Islands in 1887 (Proc. Amer. Philos. Soc.: 273-7) and 1888 (Bull. Essex Inst.: 20) on the basis of extensive collections and reports by Richardson and Maynard respectively. No *iguana* was mentioned. Thus if *I. delicatissima* actually occurs in the Caymans it would seem to have gotten there since 1888, probably by human agency.

The record of *delicatissima* from Swan Island, by Cope, in 1869, was based on a specimen I have not seen. Specimens I have seen show that Swan Island is inhabited by *i. iguana* and *i. rhinolopha* in approximately equal numbers. The presence of *delicatissima* on Swan Island might be accounted for by traffic between it and the Caymans, but neither Richardson nor Maynard noticed any of these conspicuous animals in the Caymans in the eighties (they report many species from conversation with natives, and *iguanas* would not be omitted if they were there).

Swan Island is off the coast of Honduras, and has an equal population of *i. iguana* and *i. rhinolopha*, while Honduras, the nearest mainland, has only *i. rhinolopha*. Three hypotheses might be invented to explain this situation.

1. The iguana population of Swan Island has been derived from two sources, Honduras for *i. rhinolopha* and Panamá for *i. iguana*. This would imply human agencies, especially for the presence of *i. iguana*.

2. The iguana population of Swan Island has been derived (by whatever agency) from the nearest mainland. This would imply a change in the mainland population, i.e., that the horned mutation (*i. rhinolopha*) appeared in the north and gradually spread southwards, supplanting the hornless strain; that Swan Island received its population at a time when the population of the nearest mainland was half and half; that since that time the horned strain has moved further south (at present the horned strain occupies the whole Caribbean coast as far south as western Panamá).

3. The horned strain has appeared independently on Swan Island and has succeeded so well that it is represented by half the population. I think the second of these three explanations the most plausible.

I wish to thank the authorities of the museums mentioned for their kindness in allowing me to examine their specimens. I also wish to thank the National Research Council for a Grant under which most of the work was done.

HAVERFORD COLLEGE, HAVERFORD, PENNSYLVANIA.

Some Observations on Captive Snakes

By GEORGE P. MEADE

THE scarcity of definite information on the breeding habits of snakes is emphasized by Florence Lowden Wood in her article on the mating of rattlesnakes (COPEIA, July, 1933). It may therefore be of interest to record certain facts concerning several varieties of the harmless water-snakes of Louisiana.

At the beginning of April, 1933, I had on hand about two dozen specimens, all of which had been caught locally. These were housed in an outdoor cage of wire mesh, about three feet wide and six feet long, which contained a concrete pool some four inches deep occupying half the floor space of the cage. The portion of the bottom of the cage outside the pool was covered with loose gravel. The snakes comprised two or three Graham's water-snakes, five or six each of *Natrix rhombifera* and *N. cyclopion* of various sizes and about ten specimens of *N. fasciata*. There were also present in the same cage a garter-snake and a ribbon-snake as well as several different varieties of turtles.

The whole collection lived together in apparent contentment except at feeding time when the snakes fought vigorously, among themselves and with the turtles, for the possession of fish, frogs or toads. The Graham's water-snakes were an exception, as they were never seen to feed, though they may have done so at night.

Mating activities were observed among the members of the three species *cyclopion*, *rhombifera*, and *fasciata* during the first three weeks of April. The matings invariably occurred on land, that is in the gravel-covered portion of the cage, and generally started during the morning. Coupling con-

tinued for several hours and may have extended into the night, though this was not definitely observed. No interest or excitement was evinced by any of the snakes other than those paired, and nothing was seen which remotely suggested an entwining or entanglement of several snakes or even a close balling up of the mating pair. The female lay in a rather extended position with the male above in sinuous curves as described by Blanchard (Bull. Antivenin Inst. Amer., IV (4), 1931). The male never grasped the female in his mouth as has been observed in the case of mating king-snakes.

Many of these snakes were given to various zoos during the succeeding months but several were retained throughout the summer. On June 25 at about 8:00 A.M. the garter-snake gave birth to 21 young, the birth of most of the snakes being witnessed by several observers. This specimen must have been pregnant when captured in late March as it was the only one of the species in the collection. The small snakes were active and healthy and ate freely of earthworms the day after they were born. The mother would not eat until three days later. The early arrival of this brood was probably due to the unusually mild weather which prevailed in Louisiana last January and February, which may have advanced the mating season.

The only specimen of *cyclopion* which was retained gave birth to seven young on August 11, about four months after the mating season. The birth occurred at about 8:00 A.M. as in the case of the garter-snakes. All the snakes of both broods shed their skins soon after leaving the natal sac.

Word has been recently received that a female *fasciata* which I sent to a private collection in Minneapolis produced seventeen young at about the same time, (i.e. early August), which would indicate that the period of gestation for both *cyclopion* and *fasciata* is the same.

While the evidence is strongly against any entangling or massing together of several individuals during mating, the stories of bundles of entwined snakes cannot be dismissed as false. A few years ago, before we had developed any special interest in reptile study, my wife saw a struggling mass of snakes rolling around in a small pond near our house. A dozen or so other snakes were swimming around or toward the central group. She called the attention of a nearby workman to the "snakes fighting" as she supposed them to be, and reported the occurrence in detail to me the same day, which was in the early spring. The workman told me later that the snakes were "breeding" and that he had seen similar activities several times in his life. Other reliable persons, none of whom could have had any access to the literature on the subject, have told me of seeing entangled snakes in large bundles, struggling and rolling in the water or soft mud and they were all sure that the snakes were mating.

A possible explanation of the entwined groups based on experience with my own collection is that they are fighting for food. I have frequently seen two or three water-snakes grasp the same live fish and then each one twist and turn vigorously in an effort to tear the fish from the grasp of the others. Snakes not in the contending group would crawl excitedly around with their heads held high in the air. In the wild state many individuals might take part in such struggles.

GRAMERCY, LOUISIANA.

New Alligator Lizards from the Pacific Coast

By HENRY S. FITCH

DURING the past three years, the writer has been engaged in a study of the genus *Gerrhonotus*. In the course of this study, which has so far included examination of the material in the principal Pacific Coast collections (Museum of Vertebrate Zoology, California Academy of Sciences, San Diego Society of Natural History, Stanford University, and the private collection of L. M. Klauber), three distinct forms were discovered for which no names were available. As it has seemed advisable to draw up brief descriptions of these forms, the following names are herewith proposed.

Gerrhonotus coeruleus shastensis, new subspecies

Type.—Adult male (Mus. Vert. Zool., No. 15047); collected June 27, 1932, in a meadow on the south side of Burney Creek, 3,000 feet, two miles southwest of Burney, Shasta County, California; collector, H. S. Fitch.

Diagnosis.—Ground color of head and neck distinctly different from, and lighter than, that of body; temporal scales all smooth; scales of upper arm and forearm weakly keeled or smooth; ground color often obscured by heavy pigmentation on dorsal surface of head, body, and tail; anterior medial dorsal scales of neck weakly keeled or smooth and wider than scales of rows lateral to them, usually two pairs of postnasals on each side; azygous prefrontal large, in contact with postnasals on each side; limbs well developed; size large (in relation to the other subspecies, *Gerrhonotus coeruleus coeruleus*, *G. c. palmeri*, and *G. c. principis*), head and body length from 90 to 128 mm. in adults.

Range.—Mountain ranges of northern California and southwestern Oregon, including the Cascade (southern end), Siskiyou, Warner, Trinity, Shasta, South Fork, Bully Choop, Yolla Bolly, and Sanhedrin ranges. The subspecies reaches the coast in less typical form in California from Humboldt County to Sonoma County. Confined to Transition and Canadian life zones.

Remarks.—*Gerrhonotus coeruleus shastensis* intergrades with typical *G. c. coeruleus* in the southern part of its range in Sonoma County, with *G. c. principis* on the northwest in the Siskiyou Mountain region, and with *G. c. palmeri* in the Lassen Peak region.

Gerrhonotus cedrosensis, new species

Type.—Adult male (Calif. Acad. Sci., No. 56187), collected July 23, 1923, in a cañon on southeast side of Cedros Island, Lower California, Mexico; collector, J. R. Slevin.

Diagnosis.—Fourteen longitudinal dorsal scale rows; ten dorsal rows of scales weakly keeled on the body and eight dorsal rows weakly keeled on upper side of tail near its base; dorsal scales of neck smooth, temporals and occipitals smooth and rounded, scales on sides of body smooth; all scales on fore and hind limbs smooth; less than fifty transverse dorsal scale rows between ear and back of thigh.

Range.—Cedros Island, Lower California, Mexico.

Remarks.—Only three specimens of this form are known (Calif. Acad. Sci., Nos. 56187, 59577, and 59578). It appears to be closely related to *G. multi-carinatus* of the Cape Region of Lower California, and differs from it mainly in the smaller number of transverse dorsal scale rows and lesser keeling of the scales.

Gerrhonotus scincicauda nanus, new subspecies

Type.—Adult male (Mus. Vert. Zool., No. 5402); collected July 1, 1913, South Island, Los Coronados Islands, Lower California, Mexico; collector, A. B. Howell.

Diagnosis.—Size small (maximum head and body length among 79 specimens 114 mm., average 93.3 among 49 evidently adult); upper two rows of temporals sharply keeled, lower rows weakly keeled or smooth, muzzle pointed; one to three rows of scales on upper arm weakly keeled in adults; eight dorsal rows of caudal scales strongly keeled on tail near its base; two or three rows of lateral caudals usually keeled on each side. Number of transverse scale rows reduced in both dorsal and ventral series, especially ventrals (average 60.4); dark ventral longitudinal lines conspicuous in adults, dark brown in color, transverse bands on body dark brown; a wide dark brown stripe extending across temporal region from eye to ear.

Range.—Los Coronados Islands (North, Middle, East and South), Lower California, Mexico.

Remarks.—This form is closely related to *Gerrhonotus scincicauda webbiai* of the adjacent mainland. It differs from *webbiai* mainly in size—no overlapping in size could be shown among 49 apparently adult specimens from Los Coronados Islands and 33 from San Diego County. Other differences are seen in the color pattern and the smaller number of transverse ventral scale rows.

MUSEUM OF VERTEBRATE ZOOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA.

The Courtship of *Ambystoma tigrinum*¹

By K. F. KUMPF

A number of adults of *Ambystoma tigrinum* were brought into the experimental biology laboratory of the American Museum of Natural History from Coram, Long Island, in March, 1933, and were kept under observation for courtship activities. A few days passed before any significant behavior was exhibited. Then in one day the complete story from the inception of courtship to the reception of the spermatophore by the female was unfolded. In many of its phases the "Liebesspiel" of the tiger salamander is similar to that recorded for *Ambystoma maculatum* and *Ambystoma opacum* and in a couple of features resembles the story of *Ambystoma jeffersonianum*. Consequently additional support is given to the

¹A contribution from the laboratory of experimental biology of the American Museum of Natural History.

idea that courtship behavior is essentially the same among related species and has phylogenetic significance (Noble, 1931).

Early in the morning of the day the courtship took place the salamanders were taken from the laboratory icebox where they were kept, sexes separated, when they were not being watched. Three gravid females and six males in breeding condition were placed in a dark room in an Alberene tank (24"×12"×12") with about six inches of tap water between 59 and 60 degrees Fahrenheit. Two 10-watt photographer's red bulbs directly over the tank provided the minimum illumination necessary to follow the action in the tank.

The activity began soon after the introduction of the animals into the aquarium. The group of tigers did a great deal of walking and swimming around and began to nose and push each other about the tank. As in *Ambystoma opacum* (Noble and Brady, 1933) this nosing was indiscriminate of sex although the males seemed to butt females more vigorously than other males. Males of *Ambystoma jeffersonianum*, on the other hand, have been found to possess definite ability to seek out females when courting and very seldom attempt to court members of the same sex (Kumpf and Yeaton, 1932). The nosing among the tigers was not only regardless of sex but was permitted by both males and females without any protests. The butting was not localized but in the majority of cases the male thrust his snout into the side or midventral region of the other salamander and would often swim around for several minutes holding the individual balanced on his head. After a time the nosing of the male took on some direction. After thrusting his snout into the side of the female and tossing her about he sometimes worked forward to her head and then retreated to her cloaca. In other instances he proceeded immediately to the latter region. Butting the cloaca was vigorous and often resulted in the male's lifting his companion to the surface of the water. There were no other courtship patterns such as the "waltz" of *Ambystoma opacum* (Noble and Brady, 1933) nor the "piggy-back" ride of Jefferson's salamander (Kumpf and Yeaton, 1933). Finally the male would stalk ahead for a short distance and deposit a spermatophore while rubbing his cloaca on the aquarium floor. A striking position not reported for any ambystomids except *A. jeffersonianum* was assumed by the male during this process. All feet were raised from the bottom of the tank and rigidly outstretched. His body was convulsed and his tail, raised at right angles to his body, undulated violently. When the courted animal was a female and sufficiently stimulated by the male's attentions her snout was closely applied to his cloaca at this time. As he advanced after deposition she followed him with her nose still close to his cloaca and passed her body over the spermatophore until her vent was immediately over it. Then she assumed the identical position taken by the male during the production of a spermatophore. Extracts from the original record of observations are included to give a clear picture of the courtship procedure:

11:17 A.M. Male nosing female vigorously. Begins at side, works to head and then to cloaca. Raises her high in the water. He comes to a clear space on the tank floor and leaves her to walk ahead. She follows with snout at his cloaca. He takes a step, then she, then he and then she. With tail at right angles to his body and

waving and his swollen cloaca being rubbed on the bottom of the tank he drops a spermatophore. Female's snout is closely applied in the angle between his left hind leg and tail during this time. However, she is distracted by the approach of another male and goes off without noticing spermatophore.

1:36 P.M. Two males are nosing a female. One butting especially in the cloacal region. She begins to follow him. 1:37. He deposits a spermatophore and she continues to follow, snout close to his vent. With all feet off the bottom she settles on the spermatophore and removes its head. Male and female now in tandem position as he extrudes another spermatophore. Both have all feet off the bottom and their bodies are quivering. Their tails are raised at right angles to the bodies and are waving back and forth. The female is removed from the tank and the head of the spermatophore is clearly visible in the opening of the vent. The pressure on her body resulting from handling causes a couple of eggs to be extruded and the spermatophore head is attached to one of these.

The striking position assumed by the female *Ambystoma tigrinum* during the reception of the spermatophore has been described for no other female ambystomid. The hind feet definitely do not assist in the introduction of the spermatophore into the cloaca in the fashion described for the female axolotl by Gasco (1881). All four feet were tense and rigidly outstretched in all the observations made and the female never removed more than the head of the spermatophore.

The number of spermatophores deposited by male tigers was relatively small as in the case of *A. opacum* and *A. jeffersonianum* and seldom more than one was dropped at a time. Neither the immediate presence of a female nor preliminary "Liebesspiel" activities were shown to be essential to incite deposition. On the other hand, females professed interest in only those spermatophores produced when courtship was in full swing and they brushed over and by others attached to the floor of the aquarium by males at various times. This situation is illustrated by the following notation:

10:54 A.M. Male has tail at right angle to bottom of tank—all feet off bottom, tail waving, body convulsed. He drops a spermatophore. There have been no courtship activities immediately preceding this. A female comes along and walks over spermatophore without touching or noticing it.

Courtship activities did not persist long enough to permit any experimental studies to determine the senses involved in the "Liebesspiel" of *Ambystoma tigrinum*. However, the close application of the female's snout to the male's cloaca and his rapidly waving tail seem to indicate that cloacal and skin secretions play a large part in the stimulation of interest in *Ambystoma tigrinum* as has been reported in other ambystomids.

CONCLUSIONS

1. The courtship of *Ambystoma tigrinum* exhibits fewer patterns than the courtships of other ambystomids. It resembles that of *Ambystoma opacum* and that of *Ambystoma maculatum* in the nosing and lifting pattern but was nothing like the "waltz" of the first of these two species.

2. The "Liebesspiel" of the tiger salamander is distinguished by the characteristic position assumed by both males and females at the climax of courtship. The tail raised at an angle to the body and the lifting of all feet from the bottom of the tank constitute one of the striking patterns in the courtship of *Ambystoma jeffersonianum* as well but this position is shown by the males only in that species.

3. There is no sex discrimination at the beginning of courtship in *Ambystoma tigrinum* but soon the male noses the female more vigorously than he does the male. This agrees with the behavior of *Ambystoma opacum* and *Ambystoma maculatum* and is unlike that of *Ambystoma jeffersonianum*.

4. The number of spermatophores deposited by *A. tigrinum* is small and deposition is not necessarily controlled by the presence of females nor preceding courtship activities.

5. Cloacal and skin secretions of the male are probably the chief elements in the stimulation of interest of the female in courtship.

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AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY.

Distributional and Food Habits Notes on Utah Lizards¹

By GEORGE F. KNOWLTON and MELVIN J. JANES²

DURING the years 1930-1932, the writers have collected more than 2600 lizards in Utah in connection with a study of their food habits. This work was begun when two of the smaller desert lizards were found feeding rather extensively upon the beet leafhopper, *Eutettix tenellus* (Baker), in many of its northern Utah desert breeding grounds.³ Except where otherwise indicated, the following records are from collections in Utah during the summer of 1932. The principal vegetation in the vicinity of collection is usually given. Most of the lizards were shot with a .22 rifle, shot shells being used. The writers were assisted on a few occasions by W. L. Thomas, R. J. Costley, and Mary W. Knowlton. The kindness of Mr. J. R. Slevin of the California Academy of Sciences, in identifying forms of which the writers were uncertain is gratefully acknowledged.

1. *Crotaphytus collaris baileyi* (Stejneger).—Two specimens of the western collared lizard were watched with interest, but not collected, in Zion National Park, on July 8, 1932 (Knowlton and Janes).

2. *Crotaphytus wislizenii* Baird and Girard.—Seventy-one specimens of the leopard lizard were collected in Utah during 1932. The largest number were taken in the brush areas between Orr's Ranch and the foothills below Fisher's Pass at the south end of Skull Valley. Localities include: west of Bovine, in Boxelder County, on August 12, 1932, among shadscale;

¹ Contribution from the Department of Entomology, Utah Agricultural Experiment Station.

² Associate Entomologist and graduate student, respectively.

³ Knowlton, G. F. The beet leafhopper in northern Utah: Reptile predators. *Utah Agr. Exp. Sta. Bul. (Tech.)* 234, 1932: 46-47.

five miles north of Elberta, on September 13, among Russian thistle; upper foothills west of Fisher's Pass, September 12, brush; Hardup, September 15, among Russian thistle; nine miles south of Iosepa, September 26, greasewood, and 1 mile south, on August 31, Russian thistle; foothills six miles southeast of Kosmo, on August 20, sagebrush and Russian thistle; foothills 3 miles northeast of Low, on August 4, sagebrush and Russian thistle. A number of specimens were taken among sagebrush, rabbit brush, and junipers in the area three to seven miles east by northeast of Orr's Ranch, in Skull Valley, Tooele County. The stomach of one large specimen collected on June 20, among rabbit brush, $7\frac{1}{2}$ miles east of Orr's Ranch, contained a specimen of the sagebrush swift, *Sceloporus g. graciosus*, and in addition, three grasshoppers (*Melanoplus mexicanus*), and one lepidopterous larva. Another specimen collected 7 miles east of Orr's Ranch, on August 31, contained a large *S. g. graciosus*; the stomach of the contained swift held heads and body fragments of 12 ants. The stomach of a large *C. wislizenii*, taken upon the same date 6 miles east of Orr's Ranch, among junipers and rabbit brush, contained a small specimen of *Cnemidophorus t. tessellatus* and three grasshoppers (*Melanoplus femurrubrum*). A large specimen collected 5 miles northeast of Orr's Ranch on September 26 contained a tiny *C. t. tessellatus* and two grasshoppers (*Trimerotopsis pallidipennis*). Several small specimens were collected among sagebrush and Russian thistle 14 miles northwest of Promontory, on August 20. Several mature forms were collected in the vicinity during the season. Specimens were taken among sagebrush and rabbit brush at Willow Creek, on July 6 and September 12. Fifteen specimens were taken among rabbit brush, sage, and junipers at Willow Springs (in the area northeast of Orr's Ranch). One extremely large specimen taken on July 20 contained two large *Uta s. stansburiana*, 1 grasshopper, and 1 wasp.

3. *Uta levis* Stejneger.—The Rocky Mountain tree *Uta* was collected in three localities in Uintah Basin, in northeastern Utah. One specimen collected on September 7, on a rocky ledge bordered by sagebrush, 6 miles southeast of Fort Duchesne, contained 14 ants, 3 coccinellid beetles, 1 hymenopterous insect, and 1 spider (M. W. Knowlton, Coll.). A specimen taken on August 5, among sage and Russian thistle, 4 miles east of Gusher, contained 1 coccinellid beetle and 2 leafhoppers. A specimen taken 1 mile west of Roosevelt had eaten 3 hymenopterans.

4. *Uta stansburiana stansburiana* (Baird and Girard).—More than 1500 specimens of the northern brown-shouldered *Uta* have been taken, principally among Russian thistle; quite a number have also been taken in shadscale, and fewer in sage, greasewood and rabbit brush areas. Utah localities for 1932 include Blue Creek, Bovine, Bovine Point, Cedar Creek, Clive, Clover, Delle, Desert, Domolite, Elberta, Fisher's Pass, Flux, Fort Duchesne, Goshen, Grantsville, Gusher, Hardup, Iosepa, Kelton, Kosmo, La Sal, Low, Lucin, Moab, Orr's Ranch, Ouray, Penrose, Promontory, Raft River Mountains, Rosebud Ranch, Sardine Canyon, Skull Valley (one specimen was taken from the stomach of a wandering garter snake), Sphinx, Timpie, The Dells, Valley Junction, Willow Creek, and Willow

Springs. This lizard is an important predator of the beet leafhopper.

5. *Sceloporus graciosus graciosus* (Baird and Girard).—The sagebrush swift was collected during 1932 in the vicinity of Blanding, Blue Bench, Cedar Fort, Cedar Valley, Clover, Curlew, Duchesne, Duchesne Valley, Fisher's Pass, Flux, Fort Duchesne, Geneva, Gooseberry, Grantsville, Gusher, Hardup, Iosepa, Jensen, Lampo, Laota, La Sal, Lynden, Lucin, Moab, Monticello, Orem, Orr's Ranch, Ouray, Park Valley, Parowan, Raft River Mountains, Randlett, Rosebud Ranch, Rosette, Roosevelt, St. John, Salina Canyon, Sharon, Showell, Skull Valley, Snowville, Syracuse, Tabiona, Timpie, Willow Creek, and Willow Springs.

6. *Sceloporus elongatus* Stejneger.—Specimens of Stejneger's blue-bellied lizard were taken upon a rocky ledge near sagebrush and rabbit brush 6 miles northeast of Fort Duchesne, on September 7, 1932 (G. F. and M. W. Knowlton). Six specimens were taken on August 5, near this place, 4 miles east of Gusher, upon a rocky ridge bordered by rabbit brush and sagebrush. Two specimens were taken on August 5 among Russian thistle, along a canyon road 6 miles southwest of Duchesne. This was about a quarter of a mile from the nearest rocky ledges. These three localities are in the Uintah Basin of northeastern Utah. Two specimens were taken on July 27, along the rocky river bank near Moab; the stomach of one, taken among *Bassia*, contained 13 beetles.

7. *Sceloporus occidentalis biseriatus* (Hallowell).—One specimen of the western blue-bellied lizard was collected along a deep cut but temporarily dry irrigation ditch 3 miles south of Iosepa, below the foothills on the east side of Skull Valley, Toole County. The vegetation was *Atriplex rosea*. The stomach contained one lepidopterous specimen and insect fragments (Janes and Knowlton).

8. *Phrynosoma douglassii ornatissimum* (Girard).—Girard's short-horned horned toad was collected on August 22, 1½ and 5 miles northeast of Cedar Fort in Cedar Valley, among Russian thistle and *Atriplex rosea*. The stomach of one specimen collected on September 12, among greasewood, 4½ miles south of Iosepa, contained 2 grasshoppers (*Hesperotettix viridis*), 2 ants, and one other hymenopterous insect, in addition to 2 parasitic roundworms. Another specimen was collected on October 8, among Russian thistle, 3 miles north of Iosepa. Seven specimens were taken in the area to the east and to the north of Orr's Ranch in Skull Valley during September. The stomach of one specimen taken among greasewood and Russian thistle, 4½ miles east of Ouray, in Uintah Basin, contained 68 parasitic roundworms (G. F. and M. W. Knowlton). Another specimen was taken near the town among rabbit brush. The stomach of a specimen collected on August 12, among sagebrush 8 miles southwest of Rosette, contained 6 ants and 2 beetles. The preceding year specimens were taken near Cedar Creek, Dolomite, Grantsville, and Hardup. The stomach of a specimen taken on April 28, 1931, ten miles west of Snowville among *Gutierrezia* contained 2 chrysomelids, 1 ground beetle, 29 ants, and 10 ant head capsules.

9. *Phrynosoma platyrhinos* Girard.—A desert horned toad was col-

lected on September 13, among Russian thistle, 6 miles north of Elberta; this specimen contained 26 ants. The stomach of another specimen collected on September 3, among Russian thistle at Hardup, contained 31 ants. Specimens were taken on August 12 and 20, among sagebrush at Kosmo. The stomach of a large specimen taken on August 8, at Locomotive Springs, among shadscale, contained 5 ants, 1 scarabaeid beetle, and 25 parasitic roundworms. Three specimens were collected on August 12, among shadscale and rabbit brush at Lucin. Another specimen was taken on August 20, among Russian thistle on top of Promontory Ridge. Except for the first, these localities are all in Boxelder County. A specimen used for feeding tests in the laboratory was collected on May 10, on the sandy ridge west of Sharon. Specimens were also taken on August 1, 1931, at Bovine Point. During 1931, one specimen was taken in Nevada, west of the Great Salt Lake Desert (Knowlton).



FIG. 1. A, lateral and B, dorsal view of the head of *Phrynosoma douglassii ornatisimum* (Girard); C, lateral view of the head of *Phrynosoma platyrhinos* Girard.

10. *Cnemidophorus tessellatus tessellatus* (Say).—Two desert whip-tail lizards were taken on July 8, at Andersons, in Washington County. On July 26, specimens were taken among greasewood and Russian thistle at Cedar, in Emery County; the stomach of one specimen contained 6 lepidopterous larvae, the other 1 orthopteran. On June 27 and July 6, five specimens were collected above the mouth of the canyon to the west of Fisher's Pass, among rabbit brush, sagebrush, and junipers. On September 7, at Fort Duchesne, a collection was made among sagebrush. Specimens were collected, on June 3, among *Cheirinia repanda* 5 miles northwest of Grantsville. Specimens were also collected on July 26, among greasewood at Grassy, Emery County, and on August 5 and September 7 among sagebrush, east of Gusher; on August 31 among Russian thistle one mile south of Iosepa in Skull Valley. Two specimens were taken on July 8 among Russian thistle 5 miles north of Leeds; 1 stomach contained 13 dipterous pupae. A small specimen was taken on May 24 at Magna among Russian thistle. Two specimens were taken on July 26, 3 miles northwest of Moab; 1 stomach contained 11 chrysomelids, 11 sow bugs,

2 lepidopterous larvae, and 1 beetle; and other 1 chrysomelid larva and 5 chrysomelid adults, 3 carabaeids, and 1 lepidopterous larva. Jimson weed and *Bassia* were the principal ground covers along the river bank where collections were made. Thirty-five specimens were taken in the Orr's Ranch area of Skull Valley, most of these between June 27 to October 2, along the foothills to the east and northeast, among sagebrush, rabbit brush, and junipers. Specimens were taken on August 12 and 30, among rabbit brush and Russian thistle on Promontory Ridge. A specimen taken south of the Skull Valley Indian Reservation on June 27 among sagebrush contained 8 grasshopper nymphs, 6 lepidopterous larvae, 1 beetle, 1 click beetle, 1 dipteran, and 4 arachnids. The stomach of another specimen collected in the southern end of Skull Valley on the same date contained 11 lepidopterous larvae and one pupa, 4 cerambycids, 2 carabaeids, 2 dipterous pupae, and 2 spiders. One of the specimens collected at Valley Junction on July 27 among greasewood had eaten 98 termites, 1 fly, 1 pentatomid bug and 1 lepidopterous larva. Sixteen specimens were taken between July 6 and September 12 in the vicinity of Willow Spring, in the canyon west of Fisher's Pass to the northeast of Orr's Ranch, among sagebrush, rabbit brush, and junipers.

11. *Eumeces skiltonianus* (Baird and Girard).—One specimen of the western or Skilton's skink was taken on August 31, 1932, in the foothills to the east of Fisher's Pass, $3\frac{1}{2}$ miles west of Clover, along the side of the canyon (W. L. Thomas).

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Giant Toads in China

By A. M. BORING and C. C. LIU

DURING March of 1932 our collector brought in to the laboratory about 100 big toads of the common Chinese species, *Bufo bufo asiaticus*, among which were some of the largest specimens we had ever seen. Among the 20 largest, the males measured 100–112 mm. from tip of snout to vent, and the females 105–140 mm. The average length of those commonly brought into the laboratory for general dissection has been about 75 mm.

No one knows much about growth, size in relation to age, or maximum size in toads. So we have been searching the literature for records of big toads. Gadow, in *Cambridge Natural History*, has many interesting facts noted. He says that the full size varies extremely, but from common experience one would call any female beyond 90 mm. or any male beyond 65 mm. unusually large. He says that they grow especially large on the mountains of southern Europe, and records one female of 135 mm. from Serra Gerez. Boulenger, in his *Tailless Batrachia of Europe*, records a female from Paris of 132 mm. and one of 130 mm. from Portugal. He mentions three Eastern specimens of *Bufo bufo* of 102 mm. from Ichang,

120 mm. from Korea and 132 mm. from Japan. Both Gadow and Boulenger refer to a record by Fatio of a toad in Sicily measuring 153 mm. and Boulenger records a statement by Mina-Palumbo that the species grows to 180 mm., but they neither seem to place much confidence in these two records, as Boulenger regards his 132 mm. toad from Paris and later Gadow his 135 mm. toad from Serra Gerez as record-breakers. In Brehm's *Tierreich* it is stated that *Bufo vulgaris* has a length of 80–120 mm., but that in such southern places as Sicily their length is 120–200 mm. In volume 3 of *China Journal of Arts and Science* there is a note and two photographs by R. L. Six (1925) recording a giant toad found at Mokanshan, the mountain resort near Hangchow, measuring 9 inches (which is about 225 mm.). The editor states that this specimen belongs to the subspecies *Bufo bufo gargarizans*, the common toad of that region. Therefore this specimen is the very largest one on record for *Bufo bufo*. These records all refer to specimens of *Bufo bufo*, the common European and North Asiatic toad.

A glance through Nieden's *Amphibia*, the section on *Bufo*, soon shows that every part of the world has one or more species which may attain a great size. Nieden does not say whether his records of size are maximum, average, or merely that of the type specimen. In India *B. melanostictus* measures 115 mm.; in the Himalayas, *B. himalayensis* 127 mm.; in Malay, *B. asper* 215 mm.; in Africa, in the Belgian Congo, *B. superciliaris* 150 mm.; in Morocco, *B. mauretania* 122 mm.; in South America, *B. guttatus* 177 mm. and *B. marinus* 200 mm.; in the United States, *B. lentiginosus* 65–140 mm., *B. cognatus* 115 mm., *B. alvarius* 135 mm., *B. boreas* 65–125 mm.; and in Cuba, *B. peltoccephalus* 130 mm.

With such a large range of size within one species, *Bufo bufo*, the question naturally arises as to the reasons for giant toads. Would all toads be giants if they did not get killed when they were young? Are all giant toads very old? Again *Cambridge Natural History* has some interesting facts recorded. The giants are always females and the chief cause of their size is plentiful food. Voracious toads may grow one-half an inch each year and reach a size of 4 inches in ten years. That would make our 140 mm. toads eleven to thirteen years old and Six's Mokanshan toad eighteen to twenty years. But Gadow reports that if growth is ever arrested by poor conditions, it can not be started again by any amount of good feeding. He also states that toads are not mature until at least five years old.

All this would suggest that giant toads must have both plenty of food and protection. The locality from which our collector brought our big toads seems to be of this nature. He found them in a secluded place at the side of a small river bottom about 4 li (one English mile) from Tangshan Village, on the way to the Ming Tombs, north of Peiping. This place is not near any village or main road and was visited by our collector because he is a fisherman by trade and regularly visits all the streams around Peiping. He has usually brought us toads from near Liuling, a village west of Peiping, where they never attain an unusual size.

Toads around Peiping are caught for three purposes: medicine, food, and laboratory use. Therefore in most places they are exposed to much danger and do not have the chance to attain a great age and size. The regular toad collectors for food and medicinal purposes frequent the Liuling region. But north of Peiping, our collector says that people do not eat toads or collect them for medicine, and the regular collectors never go there. It is city people who eat toads and use them for medicine. This Tangshan region is more isolated from Peiping than the Liuling region. Many country people in China have superstitions about big toads which keep them from killing them. Large toads with red eyes are supposed to be "fairies." While collecting in Shantung, Mr. Liu heard stories from the farmers about very large toads, but he never succeeded in seeing any of these. Therefore this group brought in by our collector probably has been protected by the farmers and never discovered by any of the regular toad collectors so that they were able to attain an unusually great age and size.

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A Contribution toward a Check List of the Urodeles of Japan

By YAICHIRO OKADA

IN January of 1931 Tago¹ published, in Japanese, a monograph of Japanese Urodeles which treated their habits and classification. He attempted to divide the Japanese Hynobiidae into two genera (*Hynobius* and *Pseudosalmandre*). In the former he included *Hynobius nebulosus*, *H. tagoi*, *H. dunni*, *H. tokyoensis*, *H. unnangso*, *H. fuscus*, *H. retardatus*, *H. cristatus*. In *Pseudosalmandre* he included *Hynobius naevius*, *H. stejnegeri*, *H. kimurai*, and *Pachypalaminus boulengeri*.

As a result of my studies, I am inclined to agree with his opinion that the Japanese Hynobiidae may be divided into two different groups. But I do not regard these groups as having enough distinct characters to warrant the recognition of two genera.

Systematic condition of the Japanese salamanders remains in confusion. We are therefore trying to make a revision of them.

During my trip through Europe, I had the opportunity to observe all the specimens of Japanese salamanders preserved in the British Museum of Natural History and also Siebold's excellent collection in the Leiden Museum, by the courtesy of the members of the herpetological departments of these museums, to whom I wish to express gratitude.

1. *Megalobatrachus japonicus* (Temminck) "Osansyouo, Hanzaki"

Type locality: Iga, Honshû.

Range in Japan: Northern Kyûshû, Southern Honshû (up to Iga, Ise, Yamato and Shinshû).

¹ Tago, K. "Imori to Sansyouo" (The Salamanders of Japan), 1931: 1-210, pl. 1-28.

This giant salamander is found in the mountain regions in the southern part of Japan proper, and is sometimes used for food or medicine. But now that it is gradually decreasing in numbers, it is protected by the Japanese government as one of the natural monuments.

2. *Tylotriton andersonii* Boulenger
"Iboyamori"

Type locality: Ryû Kyû.

Range in Japan: Amamiôshima, Ryû Kyû.

3. *Triturus² pyrrhogaster* Boie
"Imori"

Type locality: Tokyo, Japan.

Range in Japan: Honshû; Kyushû; Shikokû.

4. *Triturus ensicauda* Hallowell
"Kensakiimori"

Type locality: Ryû Kyû.

Range in Japan: Amamiôshima, Ryû Kyû.

5. *Hynobius nebulosus* (Schlegel)
"Kasumisansyouo"

Hynobius peropus Boulenger.

Type locality: Nagasaki, Kyûshû.

Range in Japan: Nagasaki; Saga; Kumamoto; Fukuoka; Oita; Nara; Shiga.

6. *Hynobius leechii* Boulenger
"Chosen Kasumi—sansyouo"

Type locality: Genzan, Korea.

Range in Japan: Genzan; Fusan; Keizyo, Chosen (Korea).

7. ?*Hynobius leechi quelpartensis* Mori

Type locality: Quelpart Islands.

Range in Japan: Tsushima.

Mori distinguished this subspecies from *Hynobius leechi*, but further observation is needed to determine its validity.

8. *Hynobius tokyoensis* Tago
"Tokyokasumi—sansyouo"

Type locality: Nishitama, Tokyo.

Range in Japan: Tokyo; Tochigi; Chiba; Ibaraki; Fukushima; Saitama.

9. *Hynobius unnangso* Tago
"Tohokukasumi—sansyouo"

Hynobius longimanus Lantz.

Type locality: Akita, Senhokugun.

Range in Japan: Miyagi; Fukushima; Niigata; Yamagata; Akita; Aomori; Iwate.

Lantz established a new species, *H. longimanus*, in his paper published in February, 1931, just after the publication of Tago's paper, in January of the same year.

² At the present time the Oriental genus *Diemyctylus* is regarded as synonymous with the genus *Triturus* of America. Many of the authorities agree with this opinion.

10. *Hynobius lichenatus* Boulenger

"Nikkokasumi—sansyouo"

Hynobius nigrescens Stejneger; *Hynobius fuscus* Tago; *Hynobius peropus* Dunn.

Type locality: Aomori.

Range in Japan: Northern Honshû to Izu and Yamato.

11. *Hynobius dunni* Tago

"Oitakasumi—sansyouo"

Type locality: Shiroyama, Saegimachi, Oita.

Range in Japan: Oita; Miyazaki.

12. *Hynobius retardatus* Dunn

"Ezo—sansyouo"

Hynobius nebulosus Sclater; *Hynobius fuscus* (part) Tago; *Hynobius lichenatus* Hatta; *Hynobius nigrescens* Hashimoto.

Type locality: Sapporo, Hokkaido.

Range in Japan: Hokkaido.

13. *Hynobius sonanni* (Maki)

"Taiwan—sansyouo"

Hynobius formosanus Maki; *Hynobius arisanensis* Maki.

Type locality: Mt. Noritaka, Formosa.

Range in Japan: Mountainous regions in Formosa.

14. *Hynobius naevius* (Schlegel)

"Buchisansyouo"

Salamandra naevia Schlegel; *Pseudosalamandre naevia* Tago.

Type locality: Mimasakû, Bizen, Okayama.

Range in Japan: Honshû; Shikokû.

15. *Hynobius kimurai* Dunn

"Hidabuchi—sansyouo"

Hynobius hida Tago.

Type locality: Hieizan Ohmi.

Range in Japan: Yamashiro; Yamato; Ohmi; Mimo; Hida: Tôtomi; Kai; Musashi; Shinano; Etyu; Kaga; Echizen (by Tago).

16. ?*Hynobius vandenburghi* Dunn

Type locality: Nara, Yamato.

Range in Japan: Nara, Yamato.

17. *Hynobius stejnegeri* Dunn

"Kyushubuchi—sansyouo"

Type locality: Kumamoto, Kyûshû.

Range in Japan: Kyûshû.

18. *Hynobius ikishimae* Dunn

"Ikisansyouo"

Type locality: Ikishima.

Range in Japan: Ikishima.

19. *Hynobius tsuensis* Abé

"Tsushima—sansyouo"

Hynobius nebulosus Tago; *Hynobius bicolor* Dunn; *Hynobius tagoi* Dunn; *Hynobius leechii tagoi* Mori; *Hynobius nebulosus tsuensis* Mori.

Type locality: Tsushima.

Range in Japan: Tsushima.

20. *Pachypalaminus boulengeri* Thompson
"Ohdaigaharabuchi—sansyouo"

Pseudosalamandre boulengeri Tago.

Type locality: Ohdaigahara, Yamato.

Range in Japan: Ohdaigahara, Yamato.

21. *Salamandrella keyserlingii* Dybowski
"Karafuto—sansyouo"

Type locality: Lake Baikal.

Range in Japan: Karafuto; Chishima.

22. *Onychodactylus japonicus* (Houttuyn)
"Hakone—sansyouo"

Type locality: Hakone, Kanagawaken.

Range in Japan: Honshû; Shikokû; Kyûshû.

23. *Onychodactylus fischeri* (Boulenger)
"Chosen—sansyouo"

Type locality: Khabarorka.

Range in Japan: Corea.

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The Anuran Fauna of Formosa

By YAICHIRO OKADA

THE Formosan anuran fauna, the richest in Japan, includes about one-third of all the species known from that country.¹ Most of the species occurring in Formosa were recorded by the German herpetologists, Werner, Vogt and others, on the basis of specimens collected by Hans Sauter in Formosa. Recently I have had the opportunity of observing these specimens, preserved in the Berlin and Hamburg museums. There have been some errors in identification in the studies on the Formosan amphibians by the German herpetologists and myself.

Following is a complete list of the tailless amphibians known from Formosa:

BUFONIDAE²

1. *Bufo melanostictus*
2. *Bufo bankorensis*

¹ Okada, Y. The Tailless Batrachians of the Japanese Empire, 1931.

² Vogt reported three more species of Bufonidae from Formosa in 1911 (*Bufo vulgaris* var. *asiatica*, *B. vulgaris* var. *japonicus* and *Bufo smithi*) in his paper in Sitzungsab. Gesellschaft Naturf. Freunde Berlin, Heft. 3, but I doubt either the locality or the identification. These three forms are members of the Palaearctic amphibian fauna, which has not been found to be represented in Formosa.

RANIDAE³

3. *Rana plancyi*
4. *Rana longicrus*
5. *Rana limocharis*
6. *Rana swinhoana* (*Rana kosempensis* Werner,⁴ *Rana adenopleura* Okada⁵)
7. *Rana ijimae*
8. *Rana latouchii*
9. *Rana tigrina*
10. *Rana rugulosa*
11. *Rana sauteri* (*Rana macropus* Okada⁶)
12. *Rana adenopleura*
13. *Rana taipehensis*
14. *Rana kuhli* (*Rana namiyei* Vogt⁷)
15. *Rhacophorus viridis*
16. *Rhacophorus moltrechti*
17. *Rhacophorus robustus*
18. *Rhacophorus eiffingeri* (*Rhacophorus braueri*⁸)
19. *Rhacophorus leucomystax* (*Rhacophorus leucomystax* var. *quad-rilineata* Vogt)
20. *Rhacophorus leucomystax sexvirgata*
21. *Rhacophorus pollicaris*
22. *Polypedates japonicus* (*Rana macropus*)

ENGYSTOMIDAE⁹

23. *Microhyla fissipes*

HYLIDAE

24. *Hyla chinensis*

485 KAMIOSAKI, SHINAGAWA-KU, TOKYO, JAPAN.

³ Boulenger once recorded *Rana guentheri* from Formosa, but this species is probably not to be found there. Boulenger may have had a specimen, *Rana sauteri*, a rather similar species.

Werner listed *Rana nigromaculata* from Kankan in Formosa in his paper in *Mitteilungen aus dem Naturhist. Mus. in Hamburg*, Heft 39, 1912. This record is very doubtful, and may be provisionally included under *Rana plancyi*. Furthermore, Werner noted that *Rana guentheri* Boulenger may be identified with *Rana sauteri*, but I found his opinion quite erroneous by examining the type specimen of *R. sauteri*, preserved in the British Museum.

⁴ Werner based a new species, *Rana kosempensis*, on eight specimens from Kosempo in Formosa (*Mitt. Naturh. Mus. Hamburg*, 39, 1912). But comparison with *Rana swinhoana*, indicates that it may be included in the synonymy of that species.

⁵ The author recorded *Rana adenopleura* from Formosa, but this record may also be included under *Rana swinhoana*.

⁶ A study of the type specimens of *Rana macropus*, preserved in the British Museum, shows that the *Rana macropus* of my paper should be identified with *Rana sauteri*. Boulenger's *Rana macropus* is quite similar to *Polypedates japonicus*.

⁷ Vogt included *Rana namiyei* in his report on the batrachian fauna of Formosa. An examination of his specimen from Formosa indicates that it may be identified with *Rana kuhli*. I suppose that *Rana namiyei* is entirely restricted to the mountainous regions of the Ryū Kyū islands.

⁸ *Rhacophorus braueri* should apparently be referred to *R. eiffingeri*, with which Ahl has synonymized it. I fully agree with him, after studying the type, preserved in the Berlin Museum.

⁹ Vogt described *M. heymosi* from Formosa (*Sitzungsab. Ges. Naturf. Freunde Berlin*, 3, 1911). In the Berlin Museum, the type specimen could not be located. Furthermore, Boulenger established *Microhyla stejnegeri*, which may be included as a synonym of *Microhyla fissipes*.

Elephantichthys copeianus, a New Cyclopterid Fish from Alaska

By CARL L. HUBBS and LEONARD P. SCHULTZ

THE subject described in this paper is a remarkable fish of the family Cyclopteridae. It is known to us from four specimens collected at Kodiak Island, Alaska, by Mr. J. T. Barnaby, who presented them along with other specimens to the junior author, and from other specimens which have subsequently been found in the collection of the National Museum.

This cyclopterid we take to be an unnamed species so distinct as to warrant the erection of a new genus for its sole reception. The genus we name *Elephantichthys* on account of its resemblance, in clumsiness of body and in thickness and rugosity of skin, to the elephant. The species is called *copeianus*, in honor of the journal COPEIA, the twentieth anniversary of which was recently celebrated.

Elephantichthys, new genus

This genus, lacking all external trace of the first dorsal fin and entirely devoid of any bony tubercles, appears to find its only near relative in *Aptocyclus* De la Pylaie, 1835: 528 (on the use of this name in place of *Cyclopterichthys* Steindachner, 1881, refer to Jordan, 1919: 183)¹. From that genus *Elephantichthys* differs in several respects, as indicated in Table 1.

The only other genus with which any comparison need be given is *Liparops* Garman (1892: 42), based on *Cyclopterus stelleri* Pallas (1811: 73). That genus is very imperfectly defined, since the type species is apparently known only from Pallas' account, derived from Steller's manuscript and the examination of a dried specimen. [We find no basis for the range assigned by Popov (1930: 76) to *Liparops stelleri*: "Northern part of Pacific; coasts of Aleutian Islands, Kamtchatka, etc."] It is, in fact, quite possible that *Elephantichthys* is not closely related to *Liparops*, for the latter is described as having a row of bony tubercles on the midline of the back, in advance of the dorsal fin, which begins in the middle of the back and extends almost to the caudal fin. Very likely *Liparops* is more closely related to *Cyclopterus* and *Eumicrotremus* than to *Elephantichthys* and *Aptocyclus*.

In connection with the relationships of *Elephantichthys* it should be remarked that Garman's (1892: 40) family Liparopsidae, reduced to subfamily rank by Jordan and Evermann (1898: 2095), hardly seems worth recognition. In the first place it is by no means sure that *Liparops* and *Aptocyclus* (*Cyclopterichthys*) are closely related. Secondly, the first dorsal fin in *Aptocyclus* and *Elephantichthys* is not absent, though it is entirely concealed under the very thick integument in the adult, without forming a dermal lump. On dissection, both these genera show five spines, the last well separated from the soft fin. The young of "*Cyclopterichthys ventri-*

¹The pertinent remarks of De la Pylaie were as follows: "J'ai formé le genre APTOCYCLE, *Aptocyclus*, pour deux poissons: l'un *A. ventricosus* affine du *Cyclogasterus ventricosus* de Pallas, et le second *A. ostracioides* N., ou Coffret, nouvelle espèce encore, très bien caractérisée."

TABLE 1. DIFFERENTIAL CHARACTERS OF *ELEPHANTICHTHYS*
AND *APTOCYCLUS*

	<i>Elephantichthys</i>	<i>Aptocyclus</i>
<i>Skeleton of jaws, skull, etc.</i>	Firm, bony	Flabby, cartilaginous
<i>Body</i>	Fairly solid, obviously not or but slightly inflatable	Very lax, greatly inflatable with air ²
<i>Trunk region (seen from above or side)</i>	Suboblong	Globular
<i>Cross section (through base of pectorals)</i>	Squarish	Round
<i>Skin</i>	Very thick, usually extremely rugose (at least in preserved specimens)	Moderately thick, largely smooth
<i>Ventral disk</i>	Very large, as long as depth of head or nearly so, occupying half or more than half of abdomen (to anal fin)	Of moderate size, little more than half as long as head is deep, occupying a third or less than a third of abdomen
<i>Pectoral fin</i>	Largely lateral, usually with hardly a trace of dermal connection below.	Largely ventral, and connected below by a conspicuous fold which overlaps front of disk.
<i>Teeth</i>	Usually more robust and truncated	Usually more slender and more sharply pointed
<i>Jaws</i>	Lower distinctly projecting	Equal or very nearly so
<i>Obliquity of Mouth</i>	Very slight (upper lip usually entirely below eye)	Moderate (upper lip opposite lower part of eye)
<i>Gape in front view</i>	More nearly straight	More distinctly arched
<i>Mouth</i>	More transverse (lateral projection of gape about one-third anterior projection)	Less transverse (lateral projection of gape about two-thirds anterior projection)
<i>Groove behind upper lip medially</i>	Usually deep (rarely obliterated in preserved specimens)	Usually absent (sometimes shallowly developed in preserved specimens)
<i>Posterior nostril</i>	Distinctly tubular	Scarcely tubular

cosus," as recently shown by Popov (1933: 64), even show an external trace of a first dorsal fin.

We find that *Elephantichthys* agrees with every feature of the family Cyclopteridae as stated by Gill (1891: 367) in his "Diagnosis" of the family, with the exception of the characters of the vertebral column, which were not studied.

Elephantichthys copeianus, new species

(Figs. 1 and 2)

The holotype, Cat. No. 106418, Museum of Zoology, University of Michigan, a specimen 184 mm long to caudal base, was collected by J. T.

² See Snyder (1912: 437).

Barnaby in Uyak Bay, Kodiak Island, Alaska, in August, 1932. Since it was caught in a salmon trap, a shallow water habitat is indicated.

Two paratypes from the same locality, 173 and 209 mm long, go to the collection of the Department of Fisheries, University of Washington (Cat. No. 2673), while a third paratype from the same place, 179 mm long, is deposited in the U. S. National Museum (Cat. No. 93096). Six other paratypes, from Karluk, Chignik Lagoon, Bering Island and Bering Sea, are deposited in the National Museum. These, as well as two specimens of *Aptocyclus*, were kindly referred to us for examination by Dr. George S. Myers. All had been identified as *Cyclopterichthys ventricosus*.

The body is very massive, especially in the shoulder region, where it is deepest and widest. The abdomen is very long and the urosome much reduced. The anterior profile is abruptly declivous in a very convex curve from the nape region to the upper lip, beyond which the deep chin clearly projects. The groove above the upper lip is very distinct across the mid-line though shallower here than laterally (this groove may be only a product of preservation, as it is not evident in one specimen). The lower lip is interrupted by a frenum as wide as or wider than the distance between the anterior nostrils, which is 2.5 or 3.0 times as great as the distance between the two nostrils of either side. The posterior nostril as well as the anterior one is distinctly tubular, though its tube is only about as high as wide.

The teeth are strong, but more or less abruptly truncated by wear, not remaining sharply conical as they do in *Aptocyclus* (in one specimen of *Elephantichthys* the teeth are longer and sharper than in the others). As in *Aptocyclus* there is an irregular file of rather large teeth, closely flanked on the outer edge by a row of smaller teeth [Popov, 1930, describes the teeth as being in five series in *Cyclopterichthys* (= *Aptocyclus*), which is contrary to our findings].

The eye proper (cornea) is surrounded, within the orbit, by a rough ring of flesh. The interorbital region is extremely broad and more or less strongly arched. The suborbital stay, very thin and ribbed, crosses the wide cheek to contact with the inner edge of the preopercle, flaring out backward to a width 7.5% of the standard length (examined in one paratype). The very small semicircular gill opening does not reach downward to the upper end of the pectoral base.

The skin, about 3 mm thick in the larger specimens, is superficially deeply creased in a reticular pattern. It is somewhat lax, though rather tightly bound down to the central muscle mass by connective tissue. The preserved specimens are not inflatable into a globular shape as are those of *Aptocyclus*.

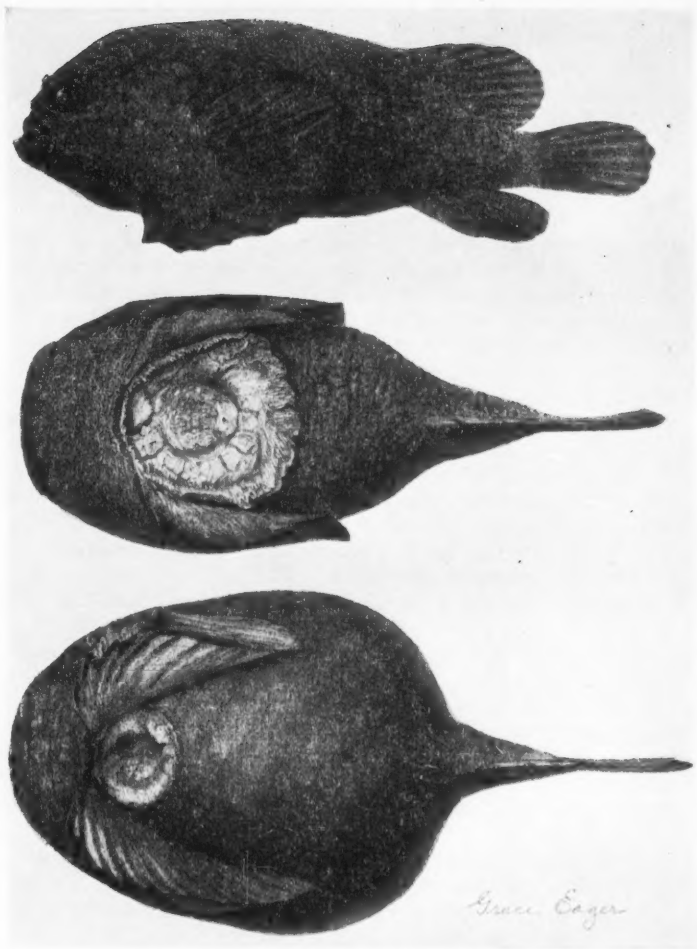
The fins are leathery and thick, except near the extreme tips of the rays; these spots sometimes forming a brokenly reticulated pattern. The into fimbriations which are markedly increased in size outward and which underlie a thin crenate membrane.

The color is a dusky to pale olive-gray over the body and fins, somewhat marbled, with more or less distinct rounded or oblong blackish spots on the upper and lateral surface of the head and body and along the fin rays, these spots sometimes forming a brokenly reticulated pattern. The

TABLE 2. COUNTS AND MEASUREMENTS^a OF *ELEPHANTICHTHYS*
AND *APTOCYCLUS*

Species:	<i>Elephantichthys copeianus</i>										<i>Aptocyclus ventricosus</i>			
Museum and Cat. No.:	U. S. N. M. 69900	U. S. N. M. 69899	Univ. Wash. 2863	U. S. N. M. 54688	U. S. N. M. 93696	Univ. Mich. 106418	U. S. N. M. 38837	U. S. N. M. 33806	Univ. Wash. 2863	U. S. N. M. 84409	Univ. Mich. 106417	U. S. N. M. 61273	Univ. Mich. 71153	U. S. N. M. 71153
Locality:	Karluk Id., Alaska	Karluk Id., Alaska	Uyak Bay, Kodiak Id., Alaska	Bering Sea	Uyak Bay, Kodiak Id., Alaska	Uyak Bay, Kodiak Id., Alaska (Holotype)	Bering Island	Bering Island	Uyak Bay, Kodiak Id., Alaska	Chignik Lagoon, Alaska	Sitkalik Id., Alaska	Locality unknown	Sea of Japan, off Teradomari	Misaki, Japan
<i>Counts:</i>														
Dorsal spines	10	10	10	10	11	10	9	9	10	9	9	10	10	9
Dorsal soft rays ^a	8	8	8	8	8	8	8	7	8	8	7	8	7	7
Anal rays ^a	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Caudal rays	20	20	21	19	21	20	20	20	20	21	21	19	21	19
Pectoral rays, left ..	20	20	21	20	20	21	19	19	20	21	21	20	20	20
Pectoral rays, right..	20	20	21	20	20	21	19	19	20	21	21	20	20	20
<i>Measurements in hundredths of standard length:</i>														
Standard length, mm	149	162	173	175	179	184	189	197	209	230	126	130	181	252
Snout to anus	61	65	59	59	65	64	62	62	63	63	79	70	73	68
Greatest depth ^b	44	43	35	37	39	36	48	39	39	36	66	52 ^d	59	52
Depth below occiput ..	34	33	34	30	36	35	37	30	35	29	44	35	32	28
Least depth	10	11	11	11	12	11	10	9	10	11	10	10	10	8
Greatest width ^b	43	41	42	47	43	46	44	42	39	49	68	52 ^d	56	52
<i>Width across</i>														
pectoral bases	43	41	42	46	43	46	41	40	39	45	55	44 ^d	50	-
Longest dorsal ray ..	27	23	23	27	26	24	24	23	22	18	18	-	24	21
Soft dorsal base	24	19	28	32	24	27	26	22	26	23	29	23	26	23
<i>Origin of dorsal to</i>														
caudal base	37	33	40	43	35	36	39	35	38	32	40	36	36	37
Longest caudal ray ..	32	28	28	30	32	27	28	26	29	27	27	32	27	26
Longest anal ray	26	23	23	25	26	21	20	18	22	19	17	-	22	20
<i>End of anal base</i>														
to caudal base	10	12	12	9	12	11	11	10	12	10	11	12	12	12
Anal base	18	14	16	21	15	16	16	13	20	17	14	16	18	13
<i>Origin of anal to</i>														
anus	13	17	15	15	17	16	21	20	12	17	21	15	20	23
Anus to disk	9	14	6	10	12	8	16	15	14	10	39	27	36	37
Length of disk	36	31	36	31	37	36	30	27	31	33	21	20	22	23
Disk to tip of mandible	23	23	24	23	23	23	22	20	22	23	24	28	23	15
<i>Longest pectoral</i>														
ray	36	32	26	34	32	29	34	28	30	30	29	-	27	24
Length of head	45	45	45	42	44	43	35	37	42	40	45	44	35	26
<i>Length, each upper</i>														
lip	17	17	18	17	17	17	15	16	16	17	17	16	13	9
Length of snout	13	14	14	12	14	14	11	12	14	12	13	15	12	8
<i>Length of fleshy</i>														
orbit	9	9	9	9	8	8	7	7	7	7	9	8	7	5
<i>Length across</i>														
cornea	6	7	5	5	5	6	5	4	3	4	6	5	5	4
<i>Least fleshy</i>														
suborbital	6	5	6	6	5	6	6	6	5	6	5	7	5	4
<i>Least fleshy inter-</i>														
orbital	23	25	24	20	22	21	20	21	23	20	23	23	18	12
<i>Postorbital length</i>														
of head	26	26	25	23	25	24	21	20	24	22	24	27	22	15
<i>Height of gill</i>														
opening	10	9	10	9	9	8	8	7	7	7	11	8	9	6

^a The extreme flabbiness of the body renders most of the measurements rather inaccurate.^b All anterior dorsal and anal rays as seen on dissection were counted; the last ray was counted as a double ray.^c In *Aptocyclus* taken when body was inflated.



FIGS. 1 to 3. *Elephantichthys* and *Aptocyclus*.

- FIG. 1 (above). Lateral view of the holotype of *Elephantichthys copeianus*.
 FIG. 2 (middle). Ventral view of same specimen.
 FIG. 3 (below). Ventral view of a specimen of *Aptocyclus ventricosus*, 126 mm in standard length, from Sitkalidak Island, Alaska.



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fins become blackish toward their extreme borders. The throat, and the belly behind the disk, are somewhat paler than the sides of the body. The disk and the inner surface of the pectoral fin where revolved in a plane with the disk, are flesh-colored. The inner face of the pectoral where it contacts with the lateral surface of the body is rather heavily and uniformly pigmented, or marked with darker blotches. The peritoneum is blackish blue; the lining of the buccal and branchial cavities is dark.

It is clear from the greatly inflated belly of Pallas' type, a character which inspired the name *ventricosus* and which was indicated in both figure and description, that *Cyclopterus ventricosus* was based on the species here called *Aptocyclus ventricosus* rather than on *Elephantichthys copeianus*. The substance of Pallas' original account (1769: 16, pl. 2, fig. 1-3) of *Cyclopterus ventricosus* was repeated by numerous writers, including Bonnatere (1788: 28, pl. 20, fig. 66) and Günther (1861: 498). Steindachner's *Cyclopterichthys glaber* (1881: 192, pl. 8) appears to have been based on the same species. Our measurements of *Aptocyclus* show an amount of variation which would ordinarily be considered beyond specific limits. Part of this is due merely to differences in the preservation of such flabby creatures, and to differential inflation. In part, however, the variation is real. Thus the head varies in length from 27 to 45 hundredths of the total length, and the parts of the head vary accordingly. But since the relative size of the head decreases rather evenly with increasing size of fish, this difference may be one of age rather than locality. The specimen from the Sea of Japan off Teradomari seemingly approaches *Elephantichthys copeianus* in being rougher than the others and in showing a slight groove behind the premaxillaries, but these look like products of preservation. Further material will be required to determine whether more than one species or subspecies of *Aptocyclus* are to be recognized.

The records of *Cyclopterichthys ventricosus* from Bering Island by Bean and Bean (1896: 242) and from Karluk on Kodiak Island, by Evermann and Goldsborough (1907: 331), were based on specimens here made paratypes of *Elephantichthys copeianus*. Snyder's account (1912: 437) of *Cyclopterichthys ventricosus* was based on *Aptocyclus* (his Misaki specimen has been reexamined). Other published records of "*Cyclopterichthys ventricosus*" are not definitely assignable to either *Elephantichthys* or *Aptocyclus*.

Cyclopterichthys amissus Vaillant (1891: 33) from the Straits of Magellan, is too scantily described to admit of comparison. Further material will be required to determine whether it may be referred to *Aptocyclus* or to *Elephantichthys*, or to a third genus of the same type.

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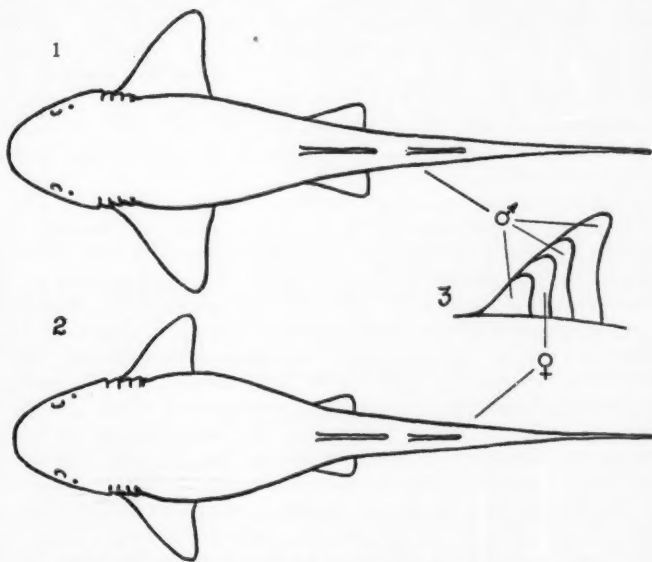
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Secondary Sex Characters of the Shark, *Ginglymostoma cirratum* (Gmelin)

By C. M. BREDER, JR.

THE presence of prominent myxopterygia in adult male elasmobranchs make the sexes immediately recognizable. Were it not for this condition the sex of most of these fishes would be at least as difficult to distinguish as it is in the generality of teleosts.



Male and female of *Ginglymostoma cirratum*, to illustrate sexual dimorphism.

1—Male 5' 1" in total length.

2—Female 5' 1" in total length.

3—Comparison of pectoral fin outlines. From left to right, male 2' 9½"; female 5' 1"; male 5' 1"; male 7' 3" in total length.

Based on tracings of photos of living specimens in the New York Aquarium, especially taken for this purpose by S. C. Dunton.

The well known nurse shark, *Ginglymostoma cirratum* (Gmelin) is a notable exception to the preceding statement, although apparently this fact is neither generally known nor recorded in the literature. Perhaps the attention of ichthyologists has been directed away from other features of sexual differentiation by the very ease with which sex in these fish may be recognized, due to the presence or absence of the claspers. It may be that the same condition will eventually be shown to exist, but to a lesser extent, in numerous other species.

Two specimens, male and female, now living in the New York Aquarium, are so close to the same size that even in photographs taken dorsally

no difference in total length can be measured. Outlines of these two fishes are given in the accompanying figure. This drawing is based on tracings of photographs especially taken for the purpose. Two photographs each showing both specimens as well as others were used, with corrections made only for the curving tails of the live fish. It may be noted at once that the pectoral fins of the male are very considerably larger than those of the female. Also that the head of the male is broadest at the first gill opening from which it slopes back rapidly, whereas the distances between the female's gill clefts are all about equal. This, in part, is undoubtedly associated with the stouter body of the latter. While the female figured is rather unusually stout, the actual coverage of the low pectorals is relatively slight as may be checked by the differences in the distance between the pectoral tips of the two sexes. There is likewise a similar but less striking difference between the size of the pelvic fins, but here the overreaching of the body's bulk makes it more apparent than real, although these fins do reach farther back in the male. The first dorsal fin is inserted slightly more anteriorly in the male.

The figure also shows a series of pectoral fins matched at their point of origin and along their anterior edges. These, also, are tracings from photographs. Reading from left to right they represent a male $2'9\frac{1}{2}"$; a female of $5'1"$; a male of $5'1"$ and a male of $7'3"$ total length. The first one and the last two show the progressive increase with size in the male, while the second shows the pectoral of a female identical in length with the third outline, that of a male. Measured proportionately, the pectorals of the males are longer than the width of the body at their insertion, i.e. at the second gill cleft. The length of the pectorals of the females are less than the body width at the same point. The length of the pectoral for this proportion is taken from the insertion (second gill cleft) in a straight line to its tip. The possible incidental differences in girth have little influence at this point, due to structural details. Also it is to be noted that the proportions given above hold good for the lengths of the pectorals of both sexes, referred to either fish shown in the figure. This proportion is valid down to a length at least as small as $2'9\frac{1}{2}"$ at which size the myxopterygia are as yet relatively undeveloped.

Aside from the biological interest in this matter there is a distinct practical value for field purposes. The distinction of sex by means of the myxopterygia is usually useful only after the shark has been captured. By the secondary characters here described, the sex of these sharks may be determined at a glance as they cruise about over the white coral sand or mud against which they are most frequently seen. Viewed dorsally, as seen from the bow of a small boat, the males seem to have pectoral fins nearly twice as long as the females, measuring along the front edge, although the difference in area is most striking. This difference may be noted in water so turbid that only the outlines of the fish can be distinguished.

Associated with the differences in the paired fins are other features not evident as field characters. The foreparts of the males are more depressed and the fish has a longer and "rangier" appearance. Viewed head-on in an aquarium the males, by virtue of their depressed foreparts and larger pectorals, lie much flatter on the bottom. Indeed, a large male

Ginglymostoma, viewed from the front, gives the impression of somewhat approaching *Pristis* in form. The females, on the other hand, due to being less flattened in body—a condition exaggerated in gravid examples—and because of their shorter pectorals, do not rest on the sea floor in the same manner, the pectorals pointing downward from the sides with only the fin tips resting on the bottom. When thus resting, these sharks frequently tuck the tip and posterior edge of these pectorals under the body or forward under the fin itself. The females are more apt to do the former; the males the latter. This implies a greater amount of flexibility and fin mobility than is present in most sharks. When starting off suddenly they seem to push against the solid bottom with their tucked-under fins, rising in what would appear to be an attempt to make a leap. At other times they will move their pectorals, digging into the sand with them as though trying to "walk." A study of the mechanics and the associated myology involved in these performances should be illuminating.

NEW YORK AQUARIUM, BATTERY PARK, NEW YORK CITY.

Some Details of the Structure of the Auditory Apparatus of *Squalus acanthias*, *Squalus suckleyi* and *Mustelus canis*

By LAWRENCE E. GRIFFIN

SOME kindly and helpful criticism by H. W. Norris, contained partly in his published papers and partly in correspondence, has led me to a reexamination of the auditory apparatus of the three elasmobranchs most commonly used for class work in this country. *Squalus suckleyi* is found on the Pacific Coast of North America, the two other species on the Atlantic coast.

Since the general structure of the elasmobranch ear is known, it is not needful to redescribe it. But my dissections have revealed some features of the ear of each of these sharks which have not been recorded with sufficient exactitude; particularly in the region of the anterior utriculus.

The ears of *S. suckleyi* and *S. acanthias* are extremely similar; the most noticeable difference being that the auditory apparatus of *S. suckleyi* is longer and not so high as that of *S. acanthias*. The ventral surface of the sacculus of *S. suckleyi* is more nearly horizontal than that of *S. acanthias*. Close comparison of the figures will show small differences in every part of the ears of the two species.

The general form of the apparatus in *Mustelus* is considerably different. The ear of *Mustelus*, while of about the same dorsoventral height as that of *Squalus*, is much shorter proportionately in its anteroposterior dimension. The sacculus, longer than high in the two species of *Squalus*, is much higher than long in *Mustelus*.

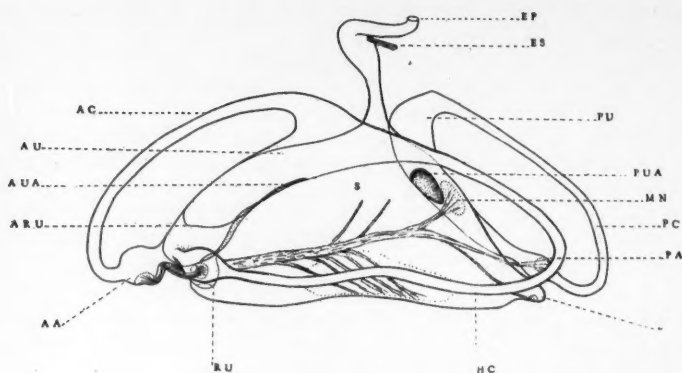


Fig. 1.—Left auditory organ of *Squalus suckleyi*, viewed from outer side. Two and two-thirds times natural size. The areas of the cristae acusticae and maculae are outlined with dots.

AA, anterior canal ampulla; AC, anterior semicircular canal; ARU, anterior margin of diverticulum sacculi; AU, anterior utricle; AUA, opening between anterior utricle and sacculus; EP, endolymphatic pore; ES, endolymphatic sac; HC, horizontal semicircular canal; L, lagena; MN, macula neglecta; PA, posterior canal ampulla; PC, posterior vertical semicircular canal; PU, posterior utricle; PUA, opening between sacculus and posterior utricle; RU, recessus utriculi; S, sacculus.

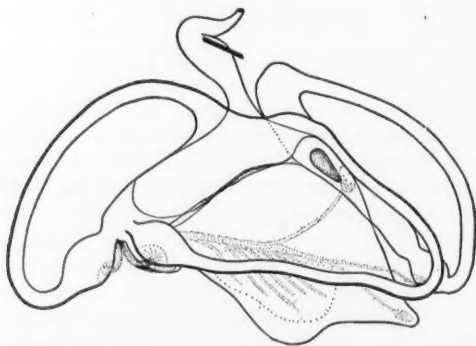


Fig. 2.—Left auditory organ of *Squalus acanthias*, viewed from outer side. are outlined with dots.

The endolymphatic pouch is larger, and its duct a little shorter in *S. acanthias* than in *S. suckleyi*. The duct and pouch of *Mustelus* are much longer than those of either *Squalus*. The pouch of *Mustelus* furthermore is bent upon itself. The muscles of the parietal fossa, short muscles passing from the lateral edges of the fossa to either lymphatic pouch, are extremely slender in *Squalus*; in *Mustelus* they are large and are attached along the greater part of the length of the pouches.

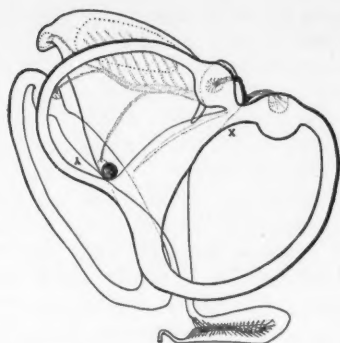
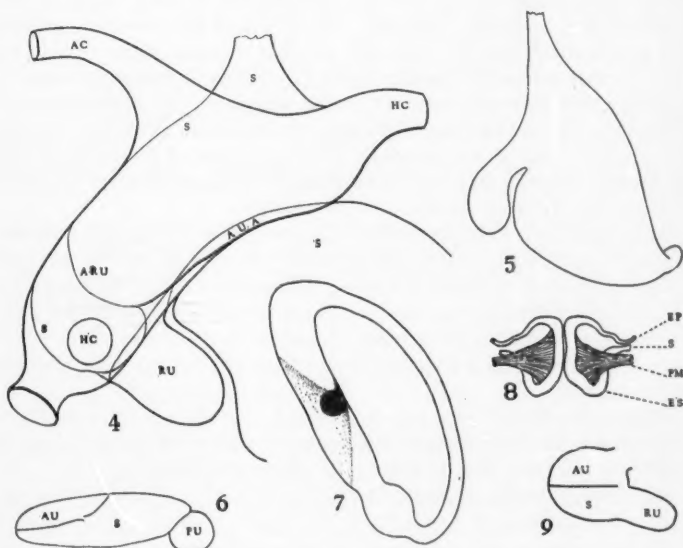


Fig. 3.—Left auditory organ of *Mustelus canis*, viewed from the outer side. Two and two-thirds times natural size.



Figs. 4 to 9.—Ear structure in sharks.

Fig. 4.—Semidiagrammatic drawing of the anterior utriculus and the related parts of the sacculus of *S. acanthias*.

Fig. 5.—Outline of the sacculus of *Mustelus canis*.

Fig. 6.—Diagrammatic section of sacculus of *M. canis*, in plane of line X-Y, figure 3.

Fig. 7.—Posterior utriculus and posterior vertical canal of *M. canis*. The small area of union with the wall of the sacculus is indicated by light shading.

Fig. 8.—Endolymphatic ducts of *M. canis* viewed from above. EP, endolymphatic pore; S, entrance to sacculus; PM, muscle of parietal fossa; ES, endolymphatic pouch.

Fig. 9.—Diagrammatic section through the opening of the horizontal canal showing relations of anterior utriculus (AU), diverticulum of sacculus (S), and recessus utriculi (RU). *S. acanthias*.

In all three species of sharks the anterior utriculus lies on and is united with the anterior and lateral surface of the sacculus. The relation of the sacculus and anterior utriculus is similar in *S. suckleyi* and *S. acanthias*. The lateral faces of the sacculus and anterior utriculus form a continuous surface. The medial and posterior sides of the anterior utriculus project into the sacculus. Medially to the anterior utriculus the sacculus projects forward as far as the anterior margin of the utriculus. The sacculus continues to lie mediad to the anterior utriculus nearly to the ventral extremity of the latter. The anteroventral portion of the sacculus forms a small diverticulum which is separated from the main portion by an infolding of the ventral wall of the sacculus. A smaller pouch, the recessus utriculi, projects from the posterior face of this diverticulum of the sacculus, and lies between the median side of the ampulla of the horizontal canal and the sacculus, almost hidden behind the ampulla in a lateral view.

The anterior utriculus of the two species of *Squalus* opens into the sacculus by a long slit-like aperture, which extends farther dorsad in *S. acanthias* than in *S. suckleyi*, but in both extends ventrad nearly to the ventral end of the anterior utriculus. The edges of this anterior utricular aperture ordinarily overlap. The edge which is external in the dorsal part of the aperture is carried spirally mediad (as it is followed downward) across the other edge and joins the medial margin of the diverticulum of the sacculus. The medial edge of the aperture continues downward parallel to the posterior wall of the utriculus. The lower part of the anterior utriculus, therefore, opens into the diverticulum of the sacculus while the upper part opens into the main chamber of the sacculus.

These relations are simpler in *Mustelus canis*, in which the diverticulum of the sacculus is more easily distinguished. In this species the anterior utricular aperture is a simple slit along the medial face of the utriculus. The lower end of the aperture opens into the diverticulum of the sacculus, the remainder of its length into the sacculus. In *Mustelus* there is no definite demarcation between the diverticulum of the sacculus and the recessus utriculi.

The fact that the sacculus and the anterior utriculus are in communication through a slit like aperture which extends almost the entire length of the utriculus does not seem to have been observed hitherto.

Other minor details of the auditory apparatus of the three species are shown by the figures.

REED COLLEGE, PORTLAND, OREGON.

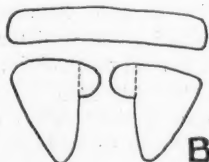
Netuma hassleriana, A New Catfish from Panama

By N. A. BORODIN

NOT long ago I came across four large catfish collected at Panama by the Hassler Expedition, no doubt by Dr. Franz Steindachner who was with Agassiz on this expedition, and who described five new catfishes from Panama—namely *Arius alatus*, *A. fürthii*, *A. brandtii*, *A. hypophthalmus*, *A. (Netuma) kessleri*.¹ Three more species (*Arius jordani*, *A. longicephalus* and *A. agassizii*) were described by Eigenmann and Eigenmann.² The type specimens of all of these species but one, namely *A.*



FIGS. A and B. Dentition on roof of mouth.



A. *Arius seemani*.

B. *Netuma hassleriana*.

alatus, are in the Museum of Comparative Zoology. A comparison of the four specimens with these types, as well as with other Panamanian catfishes, has shown me that they must be recognized as a new species. It may be called:

Netuma hassleriana, new species

Head 3.2; depth 3.75; D. I, 7; A. 14. Teeth villiform, pointed on the upper jaw, blunt on the lower jaw, vomer and palatine. The vomerine patches are small and oval, while those on palate have the form of a long triangle, the shorter side of which is confluent with the vomerine patch, while the longer side extends far backward. The upper portion of the head is roughly granulated and has a long median fontanel groove which begins between the nostrils and ends near the base of the occipital process. Barbels in three pairs; maxillary barbels the longest, about as long as the head.

Description of the type, M.C.Z. No. 33213 (formerly No. 4965), an adult female 400 mm long collected at Panama by the Hassler Expedition in 1872.

Body elongate, very high anteriorly, tapering to the tail: its depth measured from the base of dorsal fin 3.75 in length, when measured at anal fin 5.0 in length. Head large and heavy, 3.2 in length of the body, its width 1.33 in its length. Mouth large, terminal, the upper jaw longer than the lower. Maxillary barbel flat at the base, becoming roundish at the end.

¹ Ichthyol. Beiträge, IV, 1875.

² Proc. Cal. Acad. Sci., (2) 1, 1898: 142, 143, 145.

Snout short, 3 in head. Two pairs of nostrils are situated close together near the edge of the upper jaw; the posterior one is supplied with a flap, the anterior is flapless. The patches on the vomer and palatine are confluent and being joined have a very peculiar hatchet-shaped form (see Fig. B). Eye small, 10.0 in head, 5.0 in the interorbital space, which is included 2.2 times in the head. The occipital process forms a long triangle, and is contained 3.2 times in the length of the head. Gill-rakers 6+3, short, round and pointed. All of the body with the exception of the upper side of the head and of the humeral process is covered with a smooth skin, unmarked except by a kind of lateral line, consisting of numerous minute papillae (about one hundred), originating under the posterior end of the occipital process and running to the middle of the caudal fin. Dorsal and pectoral spines strong, and serrated on the anterior and posterior edges. Their length, about equal, is contained 2.0 times in head. Ventral fins are as long as the pectorals. Caudal deeply forked, its lower lobe 1.5 longer than the upper. The adipose fin is longer than the base of dorsal fin. The anal fin is very short: its base is contained 2.5 times in the head, and its rays are exceptionally few, only 14. This is one of the most important characters of the new species, since almost all catfishes of the genera *Netuma* and *Arius* have not less than 18 to 20 rays in the anal fin.

Coloration (of alcoholic specimens): uniformly blue-gray, without any spots; belly whitish; fins pale. The female type specimen has very large ovaries filled with large almost mature eggs of ovoid form, 15 by 12 mm in diameter.

The three paratypes, Cat. No. 4965, comprise one female 340 mm long and two males 300 and 320 mm long. The measurements of male specimens gives some indication of sexual dimorphism, namely: a larger head (3.33 in length), lower body (depth 5.2 in length), larger eyes (4.0 in the interorbital space) and longer maxillary barbel, reaching base of the pectoral fin. The granulation of the head is much rougher in the males than in the females. Quite possibly the males are smaller than the females; at least in our lot of four specimens both females are larger than the males.

This species seems to approach *Arius seemanni* Günther³ from Central America. In the form and length of the median fontanel and in the disposition of the vomerine and palatine patches of teeth, *N. hassleriana* resembles that species, but in the formula of its fins it is different: anal with 14 rays instead of 19, and pectoral with 1, 10 instead of 1, 12 rays. The form of the vomerine and palatine patches of teeth is also very different in details (see figure). The prominent ridges on the head, characteristic of *A. seemanni*, are absent in the new species.

Another possibly allied species, *Arius carinatus* Weber from southern New Guinea,⁴ approaches the new species in the small number of rays of the anal fin (14-16), but differs in having a shorter median fontanel and the form of the tooth patches on the jaws and vomer quite different.

MUSEUM OF COMPARATIVE ZOOLOGY, HARVARD UNIVERSITY, CAMBRIDGE, MASSACHUSETTS.

³ Cat. Fishes Brit. Mus., 5, 1864: 147-148. *Galeichthys seemanni* (Günther), in Meek and Hildebrand, *Marine Fishes of Panama*.

⁴ Nova Guinea, 9, ser. 4, 1913: 4537.

The Distinguishing Characters of Two Common Species of *Microgobius* from the East Coast of the United States¹

By ISAAC GINSBURG

IN 1883 Jordan and Gilbert described a new species of *Microgobius* under the name of *Gobius thalassinus*, on the basis of two specimens from South Carolina. Later, Eigenmann (1888) described another supposedly new species of the same genus, *M. eulepis*, from Virginia. Smith (1907) recognized *M. eulepis* from North Carolina, describing at the same time what he considered to be another new species, *M. holmesii*; but failed to recognize the older *thalassinus* from the coast of that state. Hildebrand and Schroeder (1928) recognized *eulepis* and *holmesii* from Chesapeake Bay also; and they likewise do not report *thalassinus* in that body of water.

The fate of the older *thalassinus* on the Atlantic Coast puzzled me, but, of course, there was the possibility that it represented a comparatively uncommon species. During my investigations of the Gulf coast fishes, I obtained many specimens of *Microgobius* which undoubtedly represented two distinct species, and a study was made to determine what the material represents. This study has shown that *eulepis* and *holmesii* represent the female and male, respectively, of one and the same species to which the older name *thalassinus* is to be applied. The other common species is *M. gulosus*. Both species show a very pronounced sexual dimorphism. The essential characters distinguishing them are as follows:

a. Mouth comparatively small and strongly inclined to the vertical; posterior end of maxillary not extending beyond a vertical through middle of eye, subequal in both sexes, 11 to 14% of standard length in adults. Head 25 to 28%. Fourth and fifth dorsal spine of male but moderately filamentous, extending only as far as base of fifth ray of second dorsal when stretched along the back. Body without spots. *M. thalassinus*

aa. Mouth conspicuously inclined more to the horizontal; the maxillary extending more or less beyond a vertical through posterior margin of eye in large males, varying to a distance behind eye equal to its diameter, 20 to 23% of standard length; considerably shorter in females, but usually extending beyond a vertical through middle of eye in large females, 15 to 17%. Head 30 to 32%. Fourth and fifth dorsal spines much prolonged in large males extending to base of seventh to ninth rays of second dorsal, in specimens 53 to 62 mm in total length. Body spotted. . . . *M. gulosus*

1. *Microgobius thalassinus*

Gobius thalassinus Jordan and Gilbert, Proc. U. S. Nat. Mus., 5, 1883: 612 (Charleston, South Carolina; type examined, in bad condition but apparently a male).

Microgobius eulepis Eigenmann, Proc. Calif. Acad. Sci., (2) 1, 1888: 69 (Fortress Monroe, Virginia; female, not reexamined).

Microgobius holmesii Smith, Fishes of North Carolina, 1907: 366, fig. 168 (Beaufort, North Carolina; male, not reexamined).

Microgobius eulepis Smith, *ibidem*: 368 (Beaufort, North Carolina; female, not reexamined).

Microgobius holmesii Hildebrand and Schroeder, Bull. U. S. Bur. Fish., 43 (1), 1928: 326, fig. 196 (Lewisetta, Virginia; specimens reexamined).

Microgobius eulepis Hildebrand and Schroeder, *ibidem*: 327 (mouth of Patuxent River, Maryland; females, reexamined).

¹ Published by permission of the U. S. Commissioner of Fisheries.

Diagnosis.—A broad, very low keel in front of dorsal, but no sharp membranous ridge. Scales extending on midline to a point usually falling under base of second dorsal spine, thence a bare, wedge-shaped area tapering to origin of second dorsal; 45 to 51 oblique rows to base of caudal (in 8 specimens, counting the smaller scales on upper half in anterior part of body, from the first scale on midline); a variable number of the larger scales on posterior part of body having a few spinules on middle of hind margin, but most other scales cycloid, except a small patch of modified scales under pectoral, which are unusually deep and have their almost entire exposed margin weakly spinuliferous. Second dorsal rays modally 16, often 17; anal rays 16 or 17 (the frequency distribution differing with locality, see below). First dorsal nearly always with 7 flexible spines (in 27), sometimes 8 (in 1); the fourth and fifth spine moderately long in large males, reaching to base of fourth to fifth ray of second dorsal when stretched along the back; to second or third ray in large females, gradually shorter in younger fish. Mouth conspicuously inclined to a vertical, maxillary subequal in both sexes, its posterior end reaching a vertical through anterior margin of pupil or middle of eye in large fish. Measurements of 4 males 45 to 50 mm in total length: depth (measured immediately behind base of ventral) 20 to 22, head (not including the soft membranous border) 25 to 28, maxillary 13 to 14, caudal 34 to 39, ventral 24 to 28 and pectoral 27 to 28 per cent of standard length. The same measurements in 7 females 42 to 47 mm long are: depth 18 to 23, head 26 to 27, maxillary 11 to 13, caudal 35 to 40, ventral 24 to 29 and pectoral 27 to 32%. Ventral usually extending to anus, sometimes nearly to origin of anal.

Color of head and body in preserved specimens almost uniformly dusky; 1 to 4 light colored bars behind pectoral often discernible, especially in the smaller specimens, often quite faint or absent; scales with a dark, curved, marginal streak. Male with the anal having a supramarginal row of small black spots, the rest of the fin uniformly dusky, the margin whitish; a similar row of spots sometimes present along lower margin of caudal; first dorsal without a black spot; both dorsals with rather large smoke-colored spots; a lengthwise hyaline band continued across both dorsals, nearer to base than outer margin, usually not present in largest specimens. Female without a row of spots on anal (sometimes a few diffuse spots present); first dorsal with a large black spot at its distal margin, usually between fifth and seventh spines, usually confined to interradial membrane and interrupted by the rays; longitudinal hyaline band present on two dorsals in large as well as small fish; the rest of the dorsals usually uniformly dusky, sometimes with smoke colored spots somewhat as in the male.

In life the body and head of a nearly uniform light green, iridescent with a metallic blue luster, the blue color especially developed on middle of sides, behind the pectoral; bars behind pectoral of a deeper, metallic green present, also iridescent with blue; a lengthwise, nearly median row of orange or reddish spots present on dorsal.

Largest male examined 50 mm in total length; largest female 51 mm.

Specimens examined, including the type of *thalassinus*, from the following localities: Chesapeake Bay, at mouth of Patuxent River (taken in trawl), and Cobb Island, Maryland; Lewisetta and mouth of Hampton Run, Virginia; vicinity of Beaufort, North Carolina (at Pivers Island, Newport River and Cedar Creek); Charleston Harbor, South Carolina; St. George Island, St. Vincent Island and Cape San Blas, west coast of Florida; Gulf of Mexico off Calcasieu Pass, Louisiana (taken in a shrimp trawl); Aransas Pass, Harbor Island, and Corpus Christi, Texas. This species and *gulosus* often occur together, but the largest number of specimens collected by me at one time were obtained in a pond on Cape San Blas, having partly a sandy bottom; while the numerous specimens of *gulosus* which were collected were generally taken on muddy or sometimes grassy bottoms. It is apparently not as common as *gulosus*. As noted, at least two specimens of those examined were obtained in trawls, suggesting that this species perhaps ranges in deeper water than *gulosus*, which may explain its lesser frequency in collections.

This species is readily distinguished from the following by the structural differences given in the key. The smallest specimen examined (a female 17 mm in total length) already showed the characteristic steep mouth and the spot on the first dorsal. The two species can not be separated by the number of fin rays or scales. Although the types of *eulepis* and *holmesi* were not examined, the original accounts show without a doubt that they were based on the female and male, respectively, of the present species. This became clear after the sex differences were established by a study of the many available specimens.

There is a pronounced difference in the number of anal rays and to a lesser extent also in the dorsal rays between specimens from Chesapeake Bay and from the southern states, which may possibly be used in racial differentiation:

	Dorsal rays		Anal rays	
	16	17	16	17
Chesapeake Bay	8	4	1	11
North and South Carolina	10	3	4	9
Texas and Apalachicola, Florida	14	1	7	8

Of the Chesapeake Bay fish 8 have one ray less in the second dorsal than in the anal, 3 have an equal number of rays in both fins, an 1 has one ray more in the dorsal; in the North and South Carolina fish the dorsal has one ray less in 6 and an equal number in 7 specimens, and in Gulf coast fish these relative numbers are in 7 and 8 specimens, respectively.

2. *Microgobius gulosus*

Gobius gulosus Girard, Proc. Acad. Nat. Sci. Phila., 1858: 169 (Indianola, Texas).

Diagnosis.—A broad and very low keel in front of dorsal; no sharp membranous ridge. Scales extending forward on back to vertical at base of second or third spine of first dorsal, to under origin of first dorsal on midline, in 45 to 52 oblique rows to base of caudal (in 14 specimens, counting the smaller scales on upper half, anteriorly); most of larger scales weakly spinulose in small specimens, the majority becoming cycloid in

larger fish, quite a few of the scales on posterior part of body weakly retaining their spinuliferous character; a small patch of modified scales under pectoral present, conspicuously deeper than the other scales, spinuliferous in large as well as in small specimens. Second dorsal rays modally 16 (in 16 specimens), often 17 (in 6), sometimes 15 (in 3). Anal rays modally 17 (in 19), sometimes 16 (in 4), or 18 (in 2). Dorsal usually with 1 ray less than anal (in 16), often an equal number in both fins (in 7), sometimes dorsal with 2 rays less than anal (in 2). First dorsal nearly always with 7 flexible spines (in 23), sometimes 6 (in 1) or 8 (in 1); fourth and fifth spines conspicuously long in large males, the longest reaching to base of seventh to ninth ray of second dorsal, to base of second to fourth ray in large females. Mouth inclined more to a horizontal than a vertical line; maxillary conspicuously long in large males, its posterior end extending more or less behind eye, often for a distance equalling diameter of eye; considerably shorter in females, its posterior end usually situated under the space between posterior margins of pupil and eye in large specimens. Measurements of 5 males, 53 to 62 mm in total length: depth 19 to 23, head 30 to 32, maxillary 20 to 23, caudal 31 to 36, ventral 27 to 30, and pectoral 26 to 28 per cent of standard length. Same measurements in 3 females, 47 to 62 mm long: depth 22 to 23, head 30 to 31, maxillary 15 to 17, caudal 33 to 34, ventral 26 to 29, and pectoral 26 to 28%. Ventral usually extending to origin of anal, sometimes slightly beyond origin.

Body spotted; the spots in 3 irregular rows; a row saddled on back at base of dorsal fins, another along a median line, and a row of somewhat smaller spots in between, the spots often running together and their arrangement in rows often not clearly marked; 2 or 3 dark transverse bars behind the pectoral, usually quite diffuse in males, the dark bars thus being faint, the interspaces becoming rather prominent as 1 or 2 light colored bars. Head brownish with a longitudinal, narrow, light colored band below eye, and a similar, shorter, more oblique, less clearly marked band under it. Pigmentation of body and head usually very intense in females, usually, but not always, much paler in comparison in males (in a lot of fish taken on a grassy bottom on the shore of Cat Island, Mississippi, the males are as intensely pigmented as the females). Large males with the second dorsal having a submarginal hyaline band against a dusky background; 2 or more black spots in a row in anterior part of hyaline band, the upper boundary of the black spots not clearly defined, merging more or less with the dusky ground color above, the spots sometimes forming a row nearly the full length of the fin; often another, median row of diffuse spots present, sometimes spots in median row quite dark; anal margin narrowly hyaline with a supramarginal dark band, the rest of the fin dusky; first dorsal nearly uniformly dusky; caudal with a dark, curved, somewhat interrupted band on upper half near base, and margined posteriorly with a dark band; ventral uniformly dusky. Large females with two irregular, lengthwise rows of black spots on the second dorsal, similar to spots on body; the second dorsal with a marginal dark band; anal and first dorsal similarly spotted, the spots on the anal much paler and more diffuse and

more often altogether absent, the spots on first dorsal nearly as intense as on second dorsal, those in lower row elongate; caudal with irregular transverse rows of smaller spots usually present only on upper half; ventral finely margined with white, a broad black band next to margin, the band merging posteriorly with the dusky color of the rest of the fin. The sex differences in the color pattern usually appear in fish between 30 and 35 mm in total length; smaller fish are colored more nearly like the female.

Life colors include a blue lengthwise band under eye, having a metallic luster with a greenish iridescence; a similar transverse bar behind pectoral with a smaller, more diffuse bluish bar behind it and a silvery bar immediately in front. Second dorsal of male with a lengthwise blue band and a median row of orange or reddish spots below; the caudal with a reddish tinge. The bright colors are not always evident.

Largest male examined 72 mm in total length, largest female 62 mm.

Specimens examined from the following localities: St. Johns River (at Welaka) and Indian River (at Titusville and Cocoa), on the east coast of Florida; Apalachicola Bay (Shoal Bayou, St. George Island, St. Vincent Island, and Money Bayou), Cape San Blas and Pensacola on the west coast of Florida; Cat Island and Grand Plains Bayou, Mississippi; Aransas Pass and Corpus Christi, Texas. Next to *Gobionellus boleosoma* this is the most common goby on the Gulf coast. It is, however, evidently not evenly distributed, since I did not obtain it during eight weeks of intensive collecting in the vicinity of Grand Isle, Louisiana. It is taken along the coast in the inner ponds and bayous, or in small coves within the larger sounds and bays, on a muddy or sometimes grassy bottom.

Large males of this species are unique in having an unusually large mouth, being in this respect unlike any other species of goby now known from the western Atlantic. Its proper separation from its common congener occurring with it has been pointed out above. Young specimens in which the specific structural characters are not well developed may be distinguished from *thalassinus* by the spotted body.

U. S. BUREAU OF FISHERIES, WASHINGTON, D. C.

Ichthyological Notes

NOTES ON THE ECOLOGY AND BREEDING HABITS OF THE DESERT MINNOW, *CYPRINODON MACULARIUS* BAIRD AND GIRARD.—Among the many interesting inhabitants of our western desert areas are the small, brilliantly colored (in the male only) fish that occur in some of the very scarce and usually very small bodies of water that are to be found widely separated over these exceedingly arid regions. In many places the fish are found living in water having a rather high temperature and in water which is also notable for the quantities of mineral matter which it contains.

The most abundant species of these fish is *Cyprinodon macularius*, the desert minnow, a species which is probably confined to the lower portions of the Colorado River drainage basin, including Salton Sea, although it and closely related and possibly identical species are reported from other areas. Wherever it is found in the Salton Sea area, this *Cyprinodon* appears to be exceedingly common, probably because of its surprising tolerance of enormous variations in water temperature and salinity.

Living, and apparently healthy individuals, usually young or at any rate small specimens, can sometimes be seen swimming about in isolated pools of water cut off from Salton Sea through a slight lowering of the water level, where the presence of glistening flakes of some salt in suspension indicates that the water has reached saturation point with respect to at least one mineral.

An article by George A. Coleman on the Salton Sea, appearing in California Fish and Game (15: 218-227), gives many interesting data on water analyses and related information, and it is from this source that the following note is taken.

"The author, assisted by several deputies, during the trip in March, made quite an extended search for the desert cyprinodont and found it at nearly every point where we touched shore, from a spring about seven miles above Hartley Salt works on the north shore of the sea, around to Fish Springs and Figtree John Spring where Dr. Evermann originally discovered it. We found it abundant in all these places, but especially so along the shore near the Hartley Salt Works. Here it thrives amazingly in the open sea water and Mr. Hartley states that it gets into their salt vats and will live in salt water up to 50 per cent saturation, at which point it begins to die. It evidently breeds in the tide pools and fresh water coming from these springs in among heavy growths of cattails."

The mention above of "tide pools" must be intended to mean the small residual pools along the shore which are caused by a slight recession in the level of the lake. Actual, perceptible, tides do not occur in such small bodies of water when they are cut off entirely from any connection with the sea as is this case. The writer is aware of no actual and appreciable periodical fluctuation in water level except that caused by variations in the amount of inflowing fresh water and evaporation, and these are seasonal variations.

During the past few years there has been comparatively little fluctuation in the level of the lake, certainly not enough to bring about an alteration in composition sufficient to affect the fish in the open water, yet during November, 1933, enormous numbers of dead fish were found in windrows along the beach. Since the fish are capable of tolerating sudden and great changes in their chemical environment, this situation can only be attributed to an epidemic of some kind.

It had been noted two years previously that many of the immature fish were suffering from a heavy nematode infestation and it can only be surmized that this parasite may have been instrumental in bringing about the destruction of those noted. No young fish were found among the dead but since all of the individuals were thoroughly desiccated the smaller bodies of the young may have escaped notice. No living adults were seen, although a search of several hours showed that a few small individuals were present, all apparently young of the year.

Although Coleman has stated that the fish presumably breed in the fresh water springs, pairs of these fish have been observed in the process of courtship and presumable oviposition in the marginal areas of the lake at an approximate depth of 18 inches. These observations were made miles from any fresh water springs and

judging by the abundance of the species, it is natural to assume that they may habitually breed in salt water if fresh water is not available. It is highly improbable that the few areas where fresh water and suitable breeding conditions exist, could account for the enormous numbers and wide distribution of the species in Salton Sea.

Although it is considered probable that the majority of breeding fish carry on their activities in salt or thoroughly brackish water, laboratory evidence indicates that they are entirely capable of breeding successfully in perfectly fresh water as suggested by Coleman.

During January, 1931, a number of these desert minnows were collected in Salton Sea from a point a few miles distant from Cane Springs, California. Most of the individuals were immature, and were found in schools numbering into the hundreds. They were found in shallow water over muddy bottom and when alarmed took refuge about the stems of salt-weed, sometimes called pickle-weed, a species of *Salicornia*, found dead or dying along the edge of the lake. At times, individuals escaped capture by the simple expedient of diving into the muddy ooze of the bottom.

The fish were brought back in water from Salton Sea, water having a salinity and hydrogen-ion content approximately that of sea water. Half of the collection was maintained in this water in the laboratory, the other half was placed in fresh tap-water in order to observe their tolerance of a supposedly unfavorable medium. Eventually the entire collection was placed in fresh water, where they bred in an apparently normal fashion. After several days in the fresh water some individuals developed grey-white masses of fungus and were removed and killed, those surviving were not subsequently affected.

The fish that had been kept in the salt water were not affected by the fungus until they also were transferred to fresh water, when a few of them became diseased. Aside from the appearance of the fungus there was no indication that the change in environment produced any ill effects, in fact when re-introduced into the original solution the fish showed greater distress in their adjustment than when placed in fresh water, but none of the individuals were affected by fungus, probably due to the inhibitory or destructive effect of salt on the spores and mycelium of the fungus.

By the last of February most of the individuals seemed to have attained full growth, although there was considerable discrepancy in size, some of the smaller specimens being only half the length of the largest, that is, the smaller ones at this time remained about as large as they were when collected.

Early in March, most of the larger individuals were carrying on active courtship antics, although crowding in the aquarium resulted in constant interference by other individuals. The crowding was reduced by removing the most active specimens and placing them in pairs in smaller tanks. Unfortunately in such a confined area a single female was unable to cope with the attentions of a male and all of those which had been segregated succumbed to persecution within a few days.

On being returned to the larger tanks again, the males exhibited such pugnacity toward all the other individuals that only one of these most active ones was allowed to remain. The rest of the large pugnacious males were segregated in other tanks.

On March 19 it was noticed that the largest, most active and most brilliantly colored male had established a well defined station from which all other individuals, males and females, with the exception of one large female, were driven away. Naturally, the males were most furiously attacked but it was surprising to note the attitude toward the other females. The station which had been selected was above a small stone covered with algae and sheltered by a water plant, *Potamogeton*.

The male spent most of his time above the stone and it was from this point that most of the attacks started, often, however, the attacks led to forays in all parts of the aquarium, 4x2 feet, and while away on the expeditions the other inhabitants of the tank tended to gather about the spot where courtship activities had been carried on.

The male usually returned from these forays in a short time, attacked the intruders violently, and then dropped down to the stone where he would rock back and forth and nuzzle into the algae, apparently a response from some odor left by the female. Other males while not responding as violently to this odor, were stirred to activities somewhat similar to those of the resident male.

Minor color changes are observable during courtship. The male retains the brilliant blue nuptial coloration, but the tones are slightly darker during the act of courtship, and the dark bands or crossbars which appear during fright also appear under this emotion. At the height of nuptial coloration the male is bright blue, while the dorsal fin becomes black and the anal fin is tipped on the posterior border with black. The caudal fin and part of the caudal peduncle is pale lemon yellow. The female during courtship becomes somewhat less crossbarred, and appears to be a trifle lighter in color.

The eggs were laid singly on the algae that encrusted the stone and the first one to hatch was noticed on April 5. The young fish was 5 mm in length, light tan grey in color. By April 7, 12 eggs had hatched and the young were removed to another aquarium.

The twelve young thrive until June 6, when they were measured. The average length was 20 mm at this time, the largest measuring 22 mm.

Judging by their rate of growth over this period it is thought that the schools of fish observed in January were young of the preceeding year. Since no adults happened to be taken with these schools, it is assumed that the young keep together while the adults, which were not observed, may remain in small groups as observed at other times or may take shelter in deeper water either in schools or singly.—RAYMOND B. COWLES, *Biology Department, University of California at Los Angeles, California.*

OCCURRENCE OF MACKEREL IN ALASKA.—In July 1932 a mackerel, *Pneumatophorus diego*, was taken from the herring catches in Prince William Sound, Alaska, a thousand miles beyond its reported northern limit of range in Puget Sound. Occasional occurrence of mackerel in southeastern Alaska is indicated in the following excerpt from the *Pacific Fisherman*, for September, 1932, "An unusual catch for Alaskan waters was a lot of mackerel, reported taken early in August in the Dall Head trap of the Alaskan Pacific Salmon Corporation."—GEORGE A. ROUNSEFELL and EDWIN H. DAHLGREN, *United States Bureau of Fisheries Laboratory, University of Washington, Seattle, Washington.*

MUTILATED TAILS OF STING RAYS.—In a recent issue of COPEIA, 1933 (4): 186-190, there appeared a very interesting article by Dr. E. W. Gudger on the malformation and mutilation of the tail and spine in sting-rays. Dr. Gudger advances the theory that "Various accidents might cause some of the defects listed herein, but there is but one capable of producing all of them—the bite of a shark."

With no thought of detracting from Dr. Gudger's conclusions, particularly in the case of malformation cited in *Dasyatis hastata*, it may be worth while to record a practice not at all uncommon with the fishermen along the South Carolina coast. I refer to the practice of either cutting off the tail above the spine, or cutting out the spine, and throwing the ray back in the water. It have seen this done many times, and recent inquiries among certain fishing friends amply bear out my observations. Also, the writer has caught, and seen caught, rays with their tails cut off or spines gone, and concluded that they thus showed evidence of having been caught before.

That the practice above mentioned is entirely confined to such of our common rays as *Dasyatis say* or *D. americana* is not always the case, since at least one instance is recalled in which a butterfly ray, *Pteroplatea micrura*, suffered the loss of its tail in this manner. This despite the fact that this ray had, of course, no spine, and was the victim of what practically amounted to a habit on the part of this particular fisherman.

Extenuation may be claimed for the practice of thus mutilating sting-rays when one considers the difficulty with which a ray is removed from the hook. Particularly when the hook has been swallowed, it is rather an awkward, and sometimes a dangerous, job to free the usually too active animal. In such circumstances it is much simpler to cut off the tail and then handle the ray. Of course, the ray is often killed and then the hook taken out, but this is a longer process. E. B. CHAMBERLAIN, *The Charleston Museum, Charleston, South Carolina.*

CORRECTIONS OF THE TYPE LOCALITIES OF *METZIA MESEMBRINA*, A FORMOSAN CYPRINID, AND OF *OTHONOCHEIRODUS EIGENMANNI*, A PERUVIAN CHARACIN.—*Acheilognathus mesembrinum* was described by Jordan and Evermann (Proc. U. S. Nat. Mus., 25, 1902: 323, fig. 6) from "Kotosho, Formosa." Later, Jordan and Thompson (Mem. Carnegie Mus., 6, 1914: 227) proposed the new genus *Metzia* for it, and recently Berg (COPEIA, 1932: 156) has shown that *Rasboreinus* Oshima, 1920, is a synonym of *Metzia*. It has generally been thought that *Metzia mesembrina* came from Kotosho (Botel Tobago) Island, off the southeast coast of Formosa. On looking up the data regarding the holotype (Stanford Univ. No. 7130), however, I find that it is listed in the Stanford Catalogue as from Suwata (Suwo Bay), Formosa, and there is a note in the handwriting of Prof. J. O. Snyder to the effect that the published locality was a mistake. *Metzia mesembrina* is, then, not known from Botel Tobago Island, but from the island of Formosa proper. It is possible that *Rasboreinus takakii* Oshima (Proc. Acad. Nat. Sci. Phila., 1920: 130, pl. 3, fig. 3) is a synonym.

The peculiar *Othonocheirodus eigenmanni* was described by the writer (Bull. Mus. Comp. Zool., 68, 1927: p. 114) from "Rio Cayumba, Peru." This was the locality given on the label. The collector, Dr. Wm. Ray Allen, tells me that the fish were taken at the Cayumba Rapids of the Rio Huallaga. It is possible that *Othonocheirodus*, with its close relative, *Monotocheirodon*, is a small, mountain-stream derivative of *Henochilus* or *Psolidodon*.—GEORGE S. MYERS, U. S. National Museum, Washington, D. C.

THE SPAWNING OF *ATHERINOPS INSULARUM INSULARUM*.—On the night of June 5, 1933, D. H. Fry, Jr., and the writer observed what was evidently the spawning of the Channel Island "smelt" (*Atherinops insularum insularum*) in Catalina Harbor, a sheltered bay on Catalina Island, California.

That night the entire surface of the bay was seen to be covered with dense shoals of jumping smelt. The constant splashing sounded like the rustle of leaves in a wind. When a light was turned on the jumping fish, they redoubled their activity and lashed the water to a foam. This activity of the smelt, said to be normally an open water species, continued all through that night and the two following nights, after which we left the harbor. There was no jumping during the day.

The tide was very low (—1.0 ft.) at 2:00 A.M. that night. A beach seine haul at 10:00 P.M. in the shallow cove behind Ballast Point resulted in a very large catch of immature smelt (80–130 mm, body length) and a few young fish of several species.

The light of the nearly full moon disclosed larger smelt at the head of the cove, but snags on the bottom would have made seining risky. Besides the snags, the bottom was covered here with a dense growth of moss-like algae wherein a remarkable number of large sea-hares were to be found.

As the tide ebbed, there were almost continual slow surges, each lasting several minutes, that covered the nearly level beach to a depth of 6 to 10 inches and then receded. Countless numbers of adult smelt (150–190 mm, body length) followed the swells in and out, each time progressing as far as possible toward the shore. Occasionally individuals were stranded. At the height of each surge, there was a tremendous splashing as the fish congregated in masses. At these times it was a simple matter to pick up the fish by hand in the shallow water. Between surges they could be caught in deeper water with a dip net. Even with the gentlest handling all the fish ejected either eggs or milt. They were undoubtedly spawning in the weeds. The fish followed the swells in and out from 10:00 P.M. until 5:00 A.M., by which time the rising tide had advanced far enough to cover the spawning grounds completely. The maximum excitement prevailed at extreme low tide.

The following day, at fairly high tide, a beach seine haul was made at the same spot as before. It resulted in a large catch of adult smelt and a very few young smelt (80–130 mm). The adults were all in "running" condition.

Both at night on the spawning beds and during the day in open water, the males outnumbered the females about four to one (adults only). Very likely this ratio is lessened or even reversed earlier or later in the spawning season.—RICHARD S. CROKER, California State Fisheries Laboratory, Terminal Island, California.

A NEW NAME FOR THE ALASKAN COTTOID FISH *ULCA MARMORATA* (BEAN).—In the Proceedings of the California Academy of Natural Sciences, vol. 1, 1854, p. 4, Dr. W. O. Ayres described a new cottoid fish which he called *Hemitripterus marmoratus*. The misspelling of the generic name was corrected in the second edition of the Proceedings, issued in 1873. Later in 1854, Girard proposed the generic name *Scorpaenichthys* for Ayres' fish and the species is now well known as the common large cottoid of the California coast.

In 1891 T. H. Bean (Proc. U. S. Nat. Mus., 13: 43) described a new cottoid fish, only distantly related to *Scorpaenichthys marmoratus* (Ayres), as *Hemitripterus marmoratus*, from off Sitkalidak Island, Alaska. For this fish the generic name *Ulca* was later proposed by Jordan and Evermann. According to the present International Rules of Zoological Nomenclature Bean's new name was stillborn, a homonym from the date of its proposal, and even though later linked with another generic name, cannot now be used. I therefore propose for Bean's fish the new specific name *bolini*, after Mr. Rolf Bolin of the Hopkins Marine Station of Stanford University, whose yet unpublished monograph on Californian cottoids will mark a great step forward in our knowledge of the interrelationships of these interesting fishes.

Ulca bolini, the types of which were small, grows to upwards of two feet in length and, with its great flattened head and enormous mouth, closely resembles the angler, *Lophius*. It is commonly taken in the shrimp trawls off Petersburg, Alaska, whence Stanford University has obtained several very large specimens.—GEORGE S. MYERS, U. S. National Museum, Washington, D. C.

ABOUT THE TYPES OF FISHES FROM MAURITIUS ISLAND, INDIAN OCEAN, IN THE MUSEUM OF COMPARATIVE ZOOLOGY.—In 1871-73 the late U. S. Consul Nicholas Pike sent to Professor Louis Agassiz a large collection of fishes collected by him at Mauritius, his residence. They were identified partly by F. Steindachner, who worked for some years at the Museum of Comparative Zoology, and partly by R. Bliss, an assistant of Professor Agassiz, who catalogued the whole collection, consisting of 519 lots. Bliss described 23 new species in the extremely rare periodical, "Transactions of the Royal Society of Arts and Sciences of Mauritius," new series, vol. 13, 1883, pp. 45-63, a file of which is in the library of the Boston Society of Natural History.

Here is the list of Bliss' new species: *Plectropoma lineatum* (M), *Pogonoperca reticulata*, *Glaucosoma semilunifera*, *Diagramma erythrostoma*, *Chaetodon auromarginatus* (M), *Mullus (Upeneus) microps*, *Sargus striatus*, *Scorpaena axillaris*, *Holocentrum elongatum*, *Acanthurus fasciatus* (M), *Pomacentrus agassizii*, *Pomacentrus pikei*, *Glyphidodon maculipinnis* (M), *Heliastes chrysurus*, *Pseudoscarus flavomaculatus*, *Moringua ferruginea* (M), *Gymnothorax albomaculatus*, *Gymnothorax viridipinnis*, *Gymnothorax signifer*, *Gymnothorax pikei*, *Gymnothorax elegans*, *Poecilophis pikei*, *Monacanthus rubricauda*.

Eighteen of the types described by Bliss have been located and added to the catalogue of M. C. Z. types of fishes. The five in the list marked with the letter M are missing. Two of these do not seem to ever have been included in the catalogue of accessions. Several of the Bliss species bear manuscript names proposed by Steindachner but never published by him although Bliss used them himself, appending the words "Stein. ms." to the name when he first proposed it.

In 1917 Mr. Alvin Seale inadvertently redescribed three of Bliss' species as his own, in Bull. Mus. Comp. Zool., 61 (4), 1917: 88, 90, 91. Seale's names are of course synonyms and homonyms of Bliss'. Thus *Muraena viridipinna* Seale equals *Gymnothorax viridipinnis* Bliss, *Gymnothorax pikei* Seale equals *Gymnothorax pikei* Bliss and *Gymnothorax elegans* Seale equals *Gymnothorax elegans* Bliss.

In the same collection of fishes from Mauritius are to be found several lots labelled as new species by Steindachner, but never published upon. The four species involved are found to be valid forms of the genus *Pristipomoides* Bleeker. Their descriptions, by the writer, will be published later.—N. A. BORODIN, Museum of Comparative Zoology, Cambridge, Massachusetts.

SCYLIORHINUS RETIFER EMBRYO IN CAPSULE.—Mr. J. T. Nichols, of the American Museum of Natural History, in COPEIA, 1931 (2), gave the first published description and figure of the egg case of *Scyliorhinus retifer*.

During January, February, and March, 1933, while stationed at Norfolk, Virginia, I was fortunate in having contact with Captain Frank Favaloro of the schooner "Grace F." (Gloucester, Mass.), who supplied me with many strange and rare fishes, among which were found several egg cases of this species.

These egg cases were hauled up in drag nets East by South of Chesapeake Lightship, in about 45 fathoms of water, during February 1933.

Among these cases I found one containing an almost fully developed embryo, and two containing fertilized eggs. The embryo was 75 mm long with a yolk stalk measuring 19 mm, the yolk mass being 9 mm in diameter. The case this was in measured 50×23 mm. The two cases containing the fertilized eggs were 57×23 mm and 47×18 mm respectively, in major dimensions. However, due to the method of preserving, the fertilized ova soon disintegrated and could not be saved. They were evidently in a very early stage of development.

I observed many adult specimens of *Scyliorhinus retifer* throughout January to March, in the trawls of the various vessels which made up the fleet, whenever they would tie up at the docks.

Mr. J. C. Pearson, while studying in this same general area in the winter of 1931, found several adult specimens of this shark in March only.

This seems to establish the breeding method, season and locality of this species of shark or dogfish. It is oviparous, the reproductive organs are similar to those of the skates. The shell glands are paired, oviducts paired, and both empty into a single cloacal chamber.—FRANK E. FIRTH, U. S. Bureau of Fisheries, Biological Institute, Cambridge, Massachusetts.

THE CAPTURE OF A YOUNG TARPON, *TARPON ATLANTICUS*, AT BEAUFORT, NORTH CAROLINA.—In an article in *Science* (78, Sept. 29, 1933: 284-285) entitled, "A Record of Young Tarpon at Sanibel Island, Lee County, Florida," by Margaret Storey and Louise M. Perry, reference is made to a young tarpon taken at Beaufort, North Carolina. It is stated that the specimen is in the Bureau of Fisheries. Unfortunately, this fish no longer is extant, having been destroyed inadvertently. The present writer regrets exceedingly that he is unable to offer an illustration of the specimen, which was only 20 millimeters long; not 25 as reported by Storey and Perry. A specimen of the same length once was reported from Cuba by Eigenmann (Bull. U. S. Fish Comm., 22, 1902 (1903): 222), entirely without description. An unsuccessful effort was made to locate that specimen. Fortunately, a description of the specimen from Beaufort had been prepared before it was destroyed and is offered herewith. It is hoped that the account may be of some aid in identifying this stage in the development of the tarpon when it is retaken.

Body quite strongly compressed, the fish being in transition from the leptocephalid to the adult form. Head small, quadrate in cross-section; snout depressed, two times as long as eye; eye small, bulging, entirely lateral; mouth moderate, terminal, the gape reaching under eye; teeth small, evident only in upper jaw; gular plate not clearly visible externally. Body myomeres very distinct, except on distal part of tail, about 52 (an adult examined had $32+23=55$ vertebrae). Fins, exclusive of ventrals, fairly well developed; caudal fin broadly forked; dorsal fin short, with 12 rays; anal fin long, with 20 rays, its origin under base of dorsal; pectorals rather long, inserted very low and close behind margin of opercle; vertical finfold still evident on caudal peduncle. Alimentary canal visible under magnification along ventral edge of abdomen, not yet fully invaginated. Color entirely wanting in the preserved specimen.

The specimen upon which the foregoing description is based was taken in the mouth of Core Creek, Beaufort, North Carolina, on August 21, 1929. The water at the place of capture was 8 to 10 feet deep and decidedly brackish.

The tarpon does not occur regularly on the coast of North Carolina, and no evidence indicating that it spawns there has been secured. The young one captured may have strayed to North Carolina from a more southern locality.

The identification is believed to be correct, because specimens of the young in the transition stage of both the lady-fish, *Albula vulpes*, and the ten-pounder or big-eyed herring, *Elops saurus*, the only other local species, exclusive of the eels, that pass through a leptocephalus stage, were at hand for comparison. The young tarpon is distinguished from these two species (a) by the short dorsal fin, which has 12 rays, whereas the lady-fish has 16 dorsal rays and the ten-pounder 22; (b) by the long anal which has 20 rays and its origin under the base of the dorsal, whereas in the lady-fish this fin has only 8 rays and in the ten-pounder 13, and in both species the origin of the anal is behind the base of the dorsal; and (c) by the small number of myomeres of which there are only about 52 in the tarpon, as compared with about 65 and 80, respectively, in the lady-fish and the ten-pounder.—SAMUEL F. HILDEBRAND, U. S. Bureau of Fisheries, Washington, D. C.

YOUNG CARANGIN FISHES DRIFTED BY THE GULF STREAM.—Beebe and Tee-Van, 1933, published their *Field Book of the Shore Fishes of Bermuda* (G. P. Putnam's Sons) which must comprise an unusually complete and reliable annotated list for any locality, due to their thorough and intensive field and library work in its preparation and to the several able ichthyologists who have preceded them in the study of Bermuda fishes.

My attention having again turned to the carangin fishes of the North Atlantic after being for several years fully occupied in other directions, I at first experience considerable surprise as I glance over the status of these species in Bermuda (in the above-mentioned publication), and notice the absence or rarity of certain forms there which are much more frequent stragglers in late summer and fall even along New York and southern New England, to which shores they are presumably wafted from their proper more southern habitat (mostly as young) by the waters of the Gulf Stream drift. These are *Trachurus lathami*, *Caranx hippos*, *Alectis ciliaris*, *Selene vomer* (rare in Bermuda) and *Vomer setapinnis*; and the same thing is true of the related *Trachinotus carolinus* and *Trachinotus falcatus*.

The probable explanation is that there are spawning grounds for these species in southern latitudes in or near the left (continental) edge of the Gulf Stream, and none on its opposite side. This would certainly be true of *Caranx hippos*, which, as has elsewhere been pointed out,¹ tends to be a coastal rather than an island species, and *Trachinotus carolinus* probably tends to be so no less. The same thing may be more or less true of *Selene vomer*, *Vomer setapinnis* and *Trachinotus falcatus*. This point of view deepens the enigma as to the supposedly off shore range of *Trachurus lathami* or as to where its young found drifting off the Florida Keys may have been spawned; and calls attention to how nearly nothing is known of the life history of that cosmopolitan drifter, *Alectis ciliaris*. The absence of records northward on our coast of *Caranx latus*, the commonest Bermuda species, may on the other hand be correlated with its range lying on the east instead of west side of the stream; it is certainly much more plentiful in Bahaman than in Florida waters.

Caranx bartholomaei is also more plentiful in the Bahamas than off Florida, but this species which has a mottled concealing coloration when young and drifts actually in or among the gulf weed is not only often taken in Bermuda, but common on the westerly edge of the stream as well, for it enters the bight of Cape Lookout, North Carolina with gulf weed and is occasionally taken about Woods Hole, Massachusetts, probably drifted in short there with gulf weed also.

The corollaries are the interesting part of this discussion, as they may be more or less applicable to ocean currents in general. Despite the narrowness of the stream between Florida and the Bahamas, young fishes drifting in one side of it do not cross to the other side and hence have a quite unlike trajectory of ocean distribution. This does not however apply to those living actually in or among the weed. Either they travel more from weed bunch to weed bunch than if they were drifting independently; or else the weed is driven more by cross winds than fishes drifting independently are, and they follow the weed.—J. T. NICHOLS, *American Museum of Natural History, New York City*.

¹ COPEIA, 98, 1921: 48.

Herpetological Notes

PILOT BLACK-SNAKE, *ELAPHE O. OBSOLETA*, IN ONTARIO.—

Elaphe o. obsoleta is supposed to be rather a rare reptile in Ontario. Lindsay (1931¹) in his summary of the records showing the occurrence of this snake in the province mentions several from Frontenac County. In most other areas one, or at the most, two, are all that have been recorded.

For a number of years the writer has known that this snake occurred in the eastern end of the province in fair numbers. It was formerly very common near Washburn, Frontenac County, and at Seeley's Bay, Leeds County. During the past ten years no records were made of its occurrence at these places though it was always one of the possibilities when working in the district. In June, 1932, in the vicinity of Black Rapids, Leeds County, which is about 40 miles to the east of Kingston, a specimen, 1480 mm. in length, was secured and sent to the Royal Ontario Museum of Zoology.

This snake is still quite common in Leeds County. Five specimens were noted on the roads during the week that was spent in the vicinity, but they were too badly broken to be preserved. The habit of sunning itself on the gravel roads and the antipathy of the residents who regard it as very dangerous, are gradually restricting the range to the wildest areas of the county. Happily there are great tracts of rocky land that may enable the species to survive for many years to come.—G. C. TONER, *Queen's University, Kingston, Ontario.*

COLOR IN *ANNIELLA NIGRA* FISCHER.—A collection of sixteen of the black legless lizard, *Anniella nigra* Fischer, from the same locality and alive, offered an opportunity to record accurately the exact colors occurring in this species. The coloration in this species has been stated to be quite variable but after studying this group the amount of variation seems to be much less than was expected at first. There is a remarkably small variation in color in the adult individuals, most of the variation appearing in the immature specimens and thus dependent on age.

The individuals used in this study were collected at Point Pinos, Pacific Grove, Monterey County, California, on March 23. The colors were compared with those in Ridgway (1912) and recorded while the lizards were alive. The lizards were then anesthetized and the various measurements and scale counts made.

In the young individuals of this species there is a general silver tone with distinct dorso-lateral dark lines and sometimes a dark mid-dorsal line of varying length.

TABLE I
COLOR RECORD OF IMMATURE INDIVIDUALS

No.	Dorsal surface	Chin and throat	Ventral surface		Tail
			anterior	posterior	Ventral surface
347	Hair brown (Plate XLVI)	Dusky brown (Plate XLV)	First $\frac{3}{4}$ inch strontian yellow Next 1 inch wax yellow Remainder citron yellow (Plate XVI)	Citron yellow (Plate XVI)	Citron yellow (Plate XVI)
351	Light grayish olive (Plate XLVI)	Dusky brown (Plate XLV)	Old gold to olive lake (Plate XVI)	Yellowish citrine (Plate XVI)	Mouse Gray (Plate LI)
352	Drab (Plate XLVI)	Dusky brown (Plate XLV)	Old gold to olive lake (Plate XVI)	Yellowish citrine (Plate XVI)	Yellowish citrine (Plate XVI) Tip, wood brown (Plate XL)
353	Avellaneous (Plate XL)	Dark vinaceous brown (Plate XXXIX)	Light russet- vinaceous (Plate XXXIX)	Light russet- vinaceous (Plate XXXIX)	Light russet- vinaceous (Plate XXXIX)

The dorso-lateral lines of No. 347 are fuscous blackish brown (Plate XLVI), those of the remaining individuals are seal brown (Plate XXXIX).

¹Lindsay, R. V. Pilot black snake in Ontario. Can. Field Nat., XLV, 1931: 83-85.

TABLE II
COLOR RECORD OF MATURE INDIVIDUALS

No.	Dorsal surface	Chin and throat	Ventral surface		Tail
			anterior	posterior	ventral surface
342	Blackish brown (Plate XLV)	Dark vinaceous-brown (Plate XXXIX)	Lemon chrome (Plate IV)	Wax yellow (Plate XVI)	Wax yellow (Plate XVI)
343	Fuscos black (Plate XLVI)	Warm brownish-black (Plate XXXIX)	Lemon chrome (Plate IV)	Lemon yellow (Plate IV)	Lemon yellow (Plate IV) Few brown scales
344	Blackish brown (Plate XLV)	Seal brown (Plate XXXIX)	Lemon chrome (Plate IV)	Lemon yellow (Plate IV)	Lemon yellow (Plate IV) Few brown scales
345	Clove brown (Plate XL)	Warm blackish-brown (Plate XXXIX)	First fourth wax yellow (Plate XVI) Remainder strontian yellow (Plate XVI)	Strontian yellow (Plate XVI)	Amber yellow (Plate XVI)
346	Fuscos black (Plate XLVI)	Warm blackish-brown (Plate XXXIX)	Intense lemon chrome (Plate IV)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)
348	Blackish brown (Plate XLV)	Dusky brown (Plate XLV)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)
349	Fuscos black (Plate XLVI)	Dusky brown (Plate XLV)	First third lemon chrome Remainder lemon yellow (Plate IV)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)
350	Fuscos black (Plate XLVI)	Dusky brown (Plate XLV)	Lemon chrome (Plate IV)	Strontian yellow (Plate XVI)	Strontian yellow (Plate XVI)
354	Fuscos black (Plate XLVI)	Warm brownish-black (Plate XXXIX)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV) Few brown scales
355	Fuscos black (Plate XLVI)	Warm blackish-brown (Plate XXXIX)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)
356	Fuscos black (Plate XLVI)	Warm blackish-brown (Plate XXXIX)	First ¼ inch strontian yellow (Plate XVI) Next 1½ inch lemon chrome (Plate IV) Remainder strontian yellow (Plate XVI)	Strontian yellow (Plate XVI)	Strontian yellow (Plate XVI) Many dark scales
357	Fuscos black (Plate XLVI)	Warm blackish-brown (Plate XXXIX)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)	Lemon chrome (Plate IV)

TABLE III
IMMATURE INDIVIDUALS

No.	Measurements in cm.			Scale count				
	Total length	Head to anus	Tail length	Infralabials		Supralabials		Dorsal dark rows
				Right	Left	Right	Left	
347	17.2	13.0	4.2	4	4	5	5	13
351	14.4	10.0	4.4	4	4	4	5	?
352	11.7	9.3	2.4	4	4	4	4	?
353	8.0	6.3	1.7	4	4	4	4	?

Tip of the tail of No. 353 was broken off.

TABLE IV
MATURE INDIVIDUALS

No.	Measurements in cm.			Scale count				
	Total length	Head to anus	Tail length	Infralabials		Supralabia's		Dorsal dark rows
				Right	Left	Right	Left	
342	22.6	15.3	7.3	4	4	5	5	12
343	22.6	15.5	7.1	5	5	5	5	13
344	19.6	14.7	4.9	4	4	4	4	14
345	21.3	14.3	7.0	4	4	5	6	13
346	18.2	15.2	3.0	4	4	4	5	13
348	17.4	15.8	1.6	4	4	4	4	12
349	21.5	14.8	6.7	4	4	5	4	13
350	21.9	14.6	7.3	4	4	5	5	14
354	18.5	13.7	4.8	4	4	5	5	12
355	20.5	13.7	6.8	4	4	5	5	14
356	18.6	12.5	6.1	4	4	5	5	?
357	19.5	15.2	4.3	5	5	5	4	13

Numbers 344, 346, and 348 have the end of their tails broken off.

As they become more mature the dorsal surface loses the silver tone and the dorso-lateral lines become indistinct as quantities of melanin are deposited in this area. The very light yellow ventral surface intensifies to a chrome yellow with brownish throat and with or without dark brown scales on the ventral surface of the tail. In very young specimens the skin on the ventral surface is so thin and the amount of pigment so little that the color of the internal organs may be seen through it, and, in general, secondarily influence the color of the ventral surface in their region.

After death the color of all parts fades and most rapidly when preserved as museum specimens. The yellow of the ventral surface becomes a pale yellowish white at the same time that the preserving fluid becomes a chrome yellow. Cope (1898: 675) describes the color of *A. nigra* Fischer as follows, "Upper half of body uniform dark purplish brown; beneath, yellowish white; scales slightly dotted with brown along their lateral edges, especially under the tail. Chin, throat, and across anal slit dusky." This description was evidently based upon preserved specimens and agrees with that given by Van Denburgh (1922, I: 468) for preserved specimens. Van Denburgh (1922, I: 469) gives the following data for the coloration occurring in large specimens of this species but does not state whether the specimens described were living or dead. "The entire upper surface (10, 12, or 14 rows of scales) and the ventral surface of the tip of the tail are very dark Indian purple. The chin and throat are lighter Indian purple, and there is more or less suffusion with the same color about the anus. The rest of the lower surfaces and sides are bright gamboge yellow, with chromium green staining near the center of the belly." This chromium green staining that Van Denburgh mentions seems to indicate dead specimens in which the decomposition of the digestive tract has begun. There was no chromium green staining noticed in any of the living specimens used in this study.

The color records, the measurements and the scale counts made for each individual are given in chart form as a more concise presentation of the data and also as of more practical use. The last column of Tables III and IV gives the number of the dorsal scale rows which are dark in color.

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THE SPRING MIGRATION OF THE FOUR-TOED SALAMANDER, *HEMIDACTYLUM SCUTATUM* (SCHLEGEL).—The spring migration of the four-toed salamander, *Hemidactylum scutum* (Schlegel), involves only the females, for mating is an autumn event, occurring in southern Michigan in September and October. Both sexes emerge from hibernation as soon as there has been sufficient warm weather to thaw the ground well. This ordinarily comes many days, perhaps three weeks, after the spotted salamanders have mated and laid their eggs. The males, as well as the immature of both sexes, attend to normal feeding activities while the females proceed to the water. The seeming regularity with which egg-laying begins about the third week of April suggests that temperature conditions rather than rainfall are effective in initiating the migration.

Soon after their first appearance in the spring the females may be found under the leaves at the very edge of the water. They seem to hesitate a little at this point, but they probably do not remain here long before entering. Although they have not been seen swimming, some, at any rate, must enter the water and swim, because in no other way could they reach some of the nesting places where they are found. If some enter the water and swim it is likely that all do, even though the site could be reached from land, for all must be activated by the same instinct. Moreover, that all find their nests from the water seems certain from the fact that the nesting sites chosen are almost invariably directly over the water and within a few inches of its surface. This position makes it possible for the larvae to drop into the water, as pointed out some years ago.¹ It would be difficult to believe that the salamanders could approach from above, i.e. from land, and gauge the position and distance so accurately.

These salamanders do not seek nesting sites unless they have eggs to lay. A female of adult size (with body 31.2 mm. in length,—tail missing) was found very far from the pond on April 20 when other adult females were in nesting sites. The eggs in this individual looked like the eggs in a spent female, yet she could not have laid this season and migrated so far away from the pond. Her fat-bodies were very large, a condition not normal for a female at egg-laying time. Her stomach and intestine were heavily parasitized with *Haptophrya michiganensis* (possibly the cause of the failure of eggs to develop). Apparently if there are no eggs to be laid there is no stimulus to migrate.

In view of the peculiar combination of primitive and specialized features brought out in discussions on the phylogeny of *Hemidactylum*, and the properly unsettled status of this question², it may be worth while to suggest that entering the water to find nesting sites may be a primitive habit of significance in this respect. If they sought their nesting sites by strictly terrestrial routes the phylogenetic significance of this breeding migration would be reversed.—FRANK N. BLANCHARD, Zoological Laboratory, University of Michigan, Ann Arbor, Michigan.

EUMECES IN CANADA.³—In the collection of the National Museum of Canada there are specimens of *Eumeces fasciatus*, *Eumeces septentrionalis* and *Eumeces skiltonianus* collected in Canada.

Eumeces fasciatus.—Nine from Point Pelee and one from Arner, Essex County; two from Sarnia, Lambton County; two from Peterborough, Peterborough County; one from Mountain Grove, Frontenac County. All of these localities are in southern Ontario.

The Royal Ontario Museum of Zoology has a specimen from Go Home Bay, and the Toronto Normal School contains a 156 mm. specimen from Honey Harbor. Both of these localities are in the southeastern Georgian Bay district of Ontario.

The Point Pelee skinks were taken under drift wood on the sandy lake shore

¹ Blanchard, F. N. 1923. The Life History of the Four-toed Salamander. *Amer. Nat.*, 57: 263–264.

² Bishop, S. C. 1918. *New York State Mus. Bull.*, 219, 220: 18.

Dunn, E. R. 1926. The Salamanders of the Family Plethodontidae: 25, 202.

Noble, G. K. 1931. The Biology of the Amphibia: 58.

Noble, G. K. 1931. The Biology of the Amphibia: 58.

³ Published with the permission of the Director, National Museum of Canada, Department of Mines, Ottawa.

during the summer of 1913. Eggs brought to the museum hatched in damp rotten wood. Only one specimen showed the bronze or coppery coloration. The longest specimen measures 176 mm.

Logier, of the Royal Ontario Museum, who spent about six weeks on Point Pelee during the summer of 1920, records skinks as very common in the lightly wooded and drier parts of the Point, where they were most frequently found beneath the loose bark of stumps and logs.

During the latter part of July, 1931, while collecting in the vicinity of Arden, Ontario, what seemed to be the blue-tailed skink was several times described to me by residents. On July 28 I succeeded in capturing a specimen near the village of Mountain Grove.

We climbed perhaps 150 feet from the railroad track up the steep side of the Laurentian upland, and under a two foot slab of rock lying on one of the bald granite domes a 165 mm. *Eumeces* was found.

In three directions, as far as the eye could see from this site, were these huge domes composed of granite and granite-gneiss polished and scarred by glacial action and now almost devoid of vegetation, probably due to forest fires. The French have bestowed upon this peculiar geological formation the very descriptive name *roches moutonnées* (sheep rocks). The sun-washed domes certainly do suggest the backs of giant sheep. The depressions between the promontories contain ground vegetation and half-grown poplars and maples. Some of the higher flatter areas were overgrown with blueberries. Rocks of varying sizes, pried loose by the weather, were strewn about.

Eumeces septentrionalis.—One from Onah, Manitoba, July 2, 1929. Onah is about twenty miles eastward of Brandon.

The late Mr. Norman Criddle, who forwarded this specimen, comments as follows: "I am sending an example of a swift taken by my brother Talbot at the edge of a larch bog at Onah, Manitoba. The animal is alive and it has, unfortunately, lost the tip of its tail, but it at least gives you a definite record for this locality. I may say that we have taken the species here before and also seen examples along the banks of the Assiniboine river, but they are quick and difficult to catch."

This specimen measures 135 mm.

Mr. B. J. Hales records in the Ottawa Naturalist, January, 1919, that on June 15, 1918, he made a trip to the big larch swamp about fifteen miles east of Brandon. He threw his coat on the hot sand and later found a lizard basking in the sun on top of the coat. He describes it as about seven inches long, striped and somewhat bronze in color. The animal was not collected.

Eumeces skiltonianus.—One from Vaseux Lake, south of Penticton, B. C. The collector comments that he found the specimen under a flat rock on March 16, 1926. It measures 130 mm.—CLYDE L. PATCH, *National Museum of Canada, Ottawa*.

NOTES ON SOME PARASITES OF THREE UTAH REPTILES.—In the course of research on the food habits of some Utah reptiles I found two species of Nematoda and one species of Cestoda in the stomachs of the animals so examined. Dr. B. G. Chitwood, Zoological Division, Bureau of Animal Industry, identified the nematodes and Miss M. S. Skinner of the same institution identified the cestode.

The details of the infestation follow:

Sceloporus graciosus graciosus Baird and Girard

The stomachs, only, of 53 specimens of this lizard from southern Utah were examined to determine as far as possible the food habits. A nematode, *Physaloptera retusa* Rud., was found in the stomachs of 5 out of the 53 specimens as follows:

Zion National Park, Utah; June 9, 1927; 1 nematode.

Between Bluff and Blanding, Utah; April 17, 1928; 1 nematode.

Blanding, Utah; April 18, 1928; 3 nematodes.

Price, Utah; April 14, 1928; 5 nematodes.

S. E. Utah, locality indefinite; April 14-20, 1928; 3 nematodes.

Phrynosoma platyrhinos Girard

As in the previous species the stomachs were examined and the nematode, *Physaloptera phrynosoma* Ortlepp, was found in all of the 7 stomachs as follows:

St. George, Utah; September 17, 1927; a few nematodes in the stomach.

St. George, Utah; March 31, 1928; stomach almost plugged by a mass of these nematodes.

St. George, Utah; March 31, 1928; stomach containing a very large number of nematodes.

St. George, Utah; April 22, 1928; a few nematodes present in stomach.

St. George, Utah; May 19, 1928; numerous nematodes present in stomach.

Tooele Valley, Utah; date unknown; one nematode.

Tooele Valley, Utah; date unknown; numerous nematodes present in stomach.

Trimorphodon lyrophanes (Cope)

The stomach of one specimen of this snake taken at Zion National Park, Utah, September 9, 1930, was examined by Dr. A. M. Woodbury and found to contain numerous small cestodes subsequently identified as *Oochoristica* sp.—LOWELL A. WOODBURY, *University of Utah, Salt Lake City, Utah.*

AN ADDITION TO THE FAUNA OF NEW MEXICO AND A DELETION.—Recently, in examining certain U. S. National Museum rattlesnakes, I had occasion to check No. 52273 from Steeple Rock, Grant County, New Mexico. This specimen, although a skin, fortunately has the head scales partly available. As there are four internasals it clearly belongs to the *confluentus* group, and, from the nature of the markings, particularly the postocular stripe, character of blotch-edges, tail rings, and heavy ventral mottling, I have no hesitancy in classifying it as *Crotalus confluentus oreganus*.

This is the first specimen of this subspecies to be reported from New Mexico, but its presence there is not unexpected as the U. S. National Museum has specimens from such nearby Arizona localities as the White Mountains in southwestern Apache County and the Apache Forest. Also, through the courtesy of Mr. Wallace F. Wood, I have lately seen a specimen from near Hannagan, Greenlee County.

U.S.N.M. 52273 was originally catalogued as *Crotalus pricei*, and constituted the basis of the inclusion of this species in Van Denburgh's herpetological list¹ for that state. As no other New Mexican specimens of *pricei* seem to have come to light it is necessary to make a deletion. In Arizona, *pricei* is a mountain form; so far as is now known its range is restricted in that state to the Huachuclas, Santa Ritas, Pinalinos (Mt. Graham), and Chiricahuas. The latter are not far from the New Mexican border, and if *pricei* is to be found there it would be expected in the Animas or Peloncillo Mountains.

While the close relationship of *pricei* with *triseriatus*, as pointed out by Amaral², is undoubted, I am of the opinion that the former should be recognized as a valid subspecies, *Crotalus triseriatus pricei*, based on the light blue-gray color and divided body spots of the Arizona and northern Chihuahua specimens, as compared with those from central Mexico. Southern Chihuahua specimens show intergrading tendencies, some being like those from the north, others like the Mexican plateau race. At present no specimens are available from Durango or Zacatecas so that a complete geographical picture of intergradation cannot be shown.—L. M. KLAUBER, *Natural History Museum, San Diego, California.*

¹ *Proc. Cal. Acad. Sci.*, 13 (12), Mar. 18, 1924: 229.

² *Bull. Antivenin Inst. of Am.*, 1 (2), July, 1927: 48.

REVIEWS AND COMMENTS

HANDBOOK OF FROGS AND TOADS: THE FROGS AND TOADS OF THE UNITED STATES AND CANADA. By Anna Allen Wright and Albert Hazen Wright. The Comstock Publishing Co., Inc., Ithaca, N. Y., 1933: xi+231 pp. \$2.50.—On taking up this book the student will be convinced at once that the authors understand the needs of their public. The flexible, durable binding, clear type, numerous and well printed cuts, and convenient size will signify to the student an efficient tool. A detailed examination will confirm the first impression. The keys are workable, the descriptions are adequate without being prolix, and the photographs on the whole portray quite satisfactorily the characters to be illustrated. We believe Mrs. Wright is to be credited with the best series of amphibian pictures that has been published. Incidentally, it was a delightful thought of Dr. Wright to dedicate the book to "the four American women who . . . have in the last half century contributed most notably to the study of this group." The organization of knowledge in this field has been difficult and much of the credit for the striking advances which have been made in recent years should be given to these patient, earnest students.

The criticisms which can be made of the work are remarkably few. The printers could have improved the attractiveness of the book by a better selection of type for the headings and by a better distribution of printed matter on many of the pages. This will, however, be of little concern to the student. The index would have been more useful had the scientific names been listed. The authors have themselves recorded in the preface what is apparently the only species omission—*Hyla gracilipes*. The inclusion of *Pseudacris streckeri* constitutes the type description of this hitherto undifferentiated species. The majority of amphibiologists will object to the recognition as subspecies of the color phases of *Rana pipiens* described by Weed. Whatever these phases may be, they are quite certainly not of the nature of subspecies as now understood. In future editions, a change should be made in the key to the families. The student will be confused when he discovers that the family *Leptodactylidae* is characterized by the presence of digital disks, while in *Leptodactylus albilabris* the disks are lacking. It may be suggested, also, that the book would be much easier to use if in the keys the references were to plates instead of to plates.

The needs of students in systematic amphibiology include, in addition to comprehensive treatises and detailed monographs, check-lists which are kept reasonably up to date, and manuals based upon such check-lists. A manual which contains satisfactory keys and which summarizes our knowledge of characters, relationships, and distribution not only stimulates the interest of the beginner but often serves to expedite the work of the expert. Wright's volume naturally and efficiently supplements the check-list of Stejneger and Barbour and thus makes for itself an important place in the history of systematic studies on the North American amphibians.—ALEXANDER G. RUTHVEN, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan*.

REPTILES OF THE WORLD. By Raymond L. Ditmars. New York. The Macmillan Company. 1933: xx+321 pp., 90 plates. This well-known book on reptile life, first published in 1910 by Sturgis and Walton Company and reprinted several times, is now issued in revised form by Macmillan. Changes in the text are, however, very few, aside from a modernizing of the nomenclature. The fewer pages, about 50, are due to use of smaller type. The photographs, which the author says (and rightly) form a valuable portion of the book, are identical, except for the frontispiece, with those of the earlier editions, but instead of being scattered through the book are placed all together at the end. This makes them easier to use, for they are not indexed (except according to their sequence in the list of illustrations) and there are no text references to them. The brief index could well have been expanded to include the illustrations. Typographical errors are very few. Occasional poor

expressions might well have been improved in the revision.

The statement in the preface of the first edition, and here repeated, that the writer hopes the book to be "everywhere in accord with the latest results of the scientific study of the subject" seems a little inconsistent with the almost complete absence of new information from the writer's rich experience, not to mention the herpetological literature of the past twenty years. The former inadequate remarks about the tuatara might very well have been amplified and corrected. These animals are not now diligently hunted for scientific institutions. They are rigidly protected from collectors (but not from natural enemies and unnatural conditions) by the New Zealand government. False ideas of the ordinary fecundity of species are fostered by stating only maximum numbers of young, as 75 in *Thamnophis sirtalis* and 60 in *Natrix sipedon*.

Such faults as these are small, however, when account is taken of the objective of the book and its fulfillment. Its great value lies in its provision of a popular, reliable and interesting source of information on the common reptiles of the world, covering all types, with its wealth of careful observation of habits, on both wild and captive animals, from the one man probably most able to provide it.—FRANK N. BLANCHARD, Zoological Laboratory, University of Michigan, Ann Arbor, Michigan.

DEEP-SEA ANGLER FISHES (CERATIOIDEA). By C. Tate Regan and Ethelwynn Trewavas. The Carlsberg Foundation's Oceanographic Expedition round the World 1928-1930, Report No. 2, 1932 (Oct. 11): 1-113, 10 pls. C. A. Reitzels Forlag, Copenhagen. 15 shillings.—When the late Dr. Johannes Schmidt announced that he would take the "Dana" around the world, those who were familiar with the results of his North Atlantic expedition of 1920-1922 knew that great things were in store for ichthyology. They have not been disappointed. This first of the final ichthyological reports of the later voyage revises, enlarges, and extends Dr. Regan's 1926 monograph of those extraordinary little fishes, the deep-sea anglers, which was based upon study of the material from the "Dana's" Atlantic cruise. The 1926 paper nearly doubled the number of known species; the present one nearly doubles it again.

Various chapters discuss the distribution, sexual dimorphism (including male parasitism), the lateral line, osteology, and the definition of families. These are followed by a systematic revision of the species. The fact that the males are parasitic only in certain families of ceratioids is one of the most interesting conclusions. The osteological figures are many, resulting largely from the study of specimens stained with alizarin and cleared, a method which is fast revolutionizing the examination of the skeletal anatomy of fishes too small to be dissected easily. While it seems possible that the number of species of ceratioids defined solely by modifications of the ilicium has been unduly expanded, it is scarcely appropriate to attempt criticism of a taxonomic revision by authors who have seen more material than all other students combined.

On the side of nomenclature, however, there is one serious criticism which applies not only to the paper being reviewed but to several other recent ichthyological works as well. Under the amendment to Article 25 of the International Rules of Zoological Nomenclature, adopted at the International Congress of Zoology at Budapest in 1927, new genera published subsequent to Dec. 31, 1930, without a definite and unambiguous designation of a type species, are invalid and not to be accepted under the Code. (See X^e Congrès Intern. Zool., Budapest, 1927: 1588-1589). Under this rule the generic or subgeneric names *Xenoceratias*, *Microlipichthys*, *Pentherichthys*, *Centrophryne*, *Trematorhynchus*, and *Cryptolichnus* of Regan and Trewavas are invalid, and must be republished, together with a diagnosis and a type designation, to be accepted. It is apparently to be assumed that the description of a new genus for a single species is sufficient designation of a genotype (Internat. Rules, Art. 30 c). We further note that the authors' references which cite "Beebe, Bull. N. Y. Zool. Soc." are, with the exception of the one under *Linophryne arcturi*, erroneous. The publication referred to is Zoologica, not the Bulletin. It is to be regretted that the editors have apparently not required the presence of an index in the separate reports, the more so since it is evidently not intended to collect them into volumes.

As an aid to the study of ceratioids, this paper and its companion one of 1926 are vastly more important than all previous ceratioid literature put together. Dr.

Regan and Miss Trewavas are to be congratulated on the production of one of the most valuable reports in the literature of oceanic ichthyology.—GEORGE S. MYERS, *U. S. National Museum, Washington, D. C.*

KAMONGO. By Homer W. Smith. The Viking Press, New York, 1932: 1-167. \$2.00.—Though written in the form of a novel, this book gives an interesting exposition of the habitat, habits and ecology of the African lungfish, of its place in evolution, and of course something of its physiology during aestivation in mud, for this is what the author went to Africa to study. Native lore regarding the "kamongo," reputed hybrid of a crocodile and a fish, is also presented. The author's trials in finding lungfish on his African trip are recounted so vividly that the naturalist reader may imagine himself on the expedition. All this is given as the conversation between "Joel," obviously representing the author, and an Anglican priest aboard a vessel plying through the sweltering heat of the Suez Canal.

The conversation on the lungfish and the "blind alley" into which it has evolved lead naturally into a discussion of evolution, which occupies half the book. "Joel" makes a spirited defense of the mechanistic philosophy of evolution, leading at times into dramatic tenseness, at times running on in the sheer beauty of verse, always holding interest, and presenting his point of view in such fine literary style that the book was chosen by the Book-of-the-Month Club and recommended by the Scientific Book Club. Naturalists as well as the general public will find this little volume interesting and stimulating.—CARL L. HUBBS, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

CAVE LIFE OF KENTUCKY. By Vernon Bailey, with Chapters on THE BIRDS by Florence Merriam Bailey and on THE INVERTEBRATES by Leonard Giovannoli, The University Press, Notre Dame, Indiana, 1933: 256 pp., 90 figs. \$1.25.—This attractive little bound volume was reprinted from Vol. 14, No. 5, of *The American Midland Naturalist*. The manuscript was prepared by the U. S. Biological Survey in 1930, at the request of the Kentucky State Geological Survey. Much of the field work was done by LEONARD GIOVANNOLI, now of the University of Florida. The brief Introduction treats the History and Prehistory of Mammoth Cave, Roads and Rivers, Research and Education, Vegetation and Ecology, and Game and Wild Life, all in 20 pages. Fortunately the inane, at times moronic naming of the "formations" is given almost no space. The great bulk of the book, 165 pages, treats the mammals and birds of the cave region. While these chapters, respectively by Vernon Bailey and Florence Merriam Bailey are as would be supposed very well written, there is involved little cave biology except in the discussion of the bats. In *Fishes of the Caves and Cave Region* Dr. Bailey very briefly treats the cave fishes of Mammoth Cave and adjacent caves, and lists the fishes caught there and in the Green River nearby by Mr. Giovannoli. In the chapters on *Reptiles of the Mammoth Cave Region* and on *Amphibians of the Caves and Cave Region*, the same author gives a brief annotated list. *The Invertebrate Life of Mammoth and other Neighboring Caves* was written by Leonard Giovannoli.—CARL L. HUBBS, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

DIE INDISCHE ZEEVISSCHEN EN ZEEVISSCHERIJ. (Bibliotheek van de Nederlandsch-Indische Naturhistorische Vereniging, VI.) By H. C. Delsman and J. D. F. Hardenberg. N. V. Boekhandel en Drukkerij, Batavia, 1934: i-viii, 1-388, fig. 1-273, 9 col. pl.—This volume on the fishes and fisheries of the East Indies, though written for the Dutch-speaking peoples of the Indies and the home-land, should prove of value and interest to ichthyologists of other lands. It may well serve, indeed, as a model for similar treatises on regional ichthyology.

The volume starts with an informative account of the external structure of fishes, and of their life histories, both illustrated by East Indian material. The accounts of the reproduction and larval development of East Indian fishes, in this chapter as well as through the systematic section, and also another chapter on the productivity of tropical seas, is based on the extensive original investigations by the senior author. The peculiar modes of fishing practiced through the Indies are described and figured. Of particular interest is kite-fishing by Malays and reef fishing by the Japanese, who

frighten reef-fishes (*Caesio* in particular) into a trap by swimming toward the mouth of the net while dangling weighted lines with white cloths attached.

The systematic section is preceded by an account of fish systematics, including the distinguishing of local races and the identification of postlarvae. The chapters on the various groups deal with the characters and the natural history features of the more noteworthy species. Many original observations are included, as for instance on the anchovies which have been so carefully studied by Dr. Hardenberg.

The beautiful plates of reef fishes remind the reviewer of happy hours spent with the authors on the reefs about the isles in Batavia Bay, in the fine aquarium connected with the Laboratory for the Investigation of the Sea (of which Dr. Delsman is Director and Mr. Hardenberg the Ichthyologist) and in the nearby pasar ikan (fish market), where the spoils of these tropical seas are brought in almost bewildering abundance.—CARL L. HUBBS, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

THE NATURAL HISTORY OF THE FRILLED SHARK, *CHLAMYDOSCELACHUS ANGUINEUS*. By Eugene W. Gudger and Bertram G. Smith. Article V of The Dean Memorial Volume *Archaic Fishes*, 1933: 245-319, fig. 1-31, pl. 1-5. \$1.00.—When I went to Cambridge in the autumn of 1902 I promptly looked up Glover Allen, of whom I had learned from a friend of his who was a counsellor at a summer camp to which I had been sent to recuperate from an attack of typhoid fever. Allen had just been elected Secretary of the Boston Society of Natural History and was beginning his work for the doctorate. He roomed in Perkins Hall in Cambridge, I in Conant across Oxford Street. Allen's roommate was Austin H. Clark, who was then doing some work in Garman's laboratory on the European, Asiatic and American eels of the genus *Anguilla*. What Clark told me activated my pulling the bell outside Garman's basement door and pushing my way inside I begged to be allowed to work in the reptile room and promised specimens as a recompense for the favors asked. Garman, little by little, thawed, for there was a warm, almost affectionate side to this queer, austere, and at first sight cold and distant nature. As the months went by we saw more and more of each other and I began to hear of *Chlamydoscelachus*. I saw the sad remnants of the type which Garman had dissected ruthlessly but to mighty good advantage and he showed me his early drawings and notes. Models they were of precise and painstaking observation. Then came the story of the now historic controversy with Cope. There is no use trying to hide the fact that Garman did not like Cope. He had met him on the fossil fields of the west and saw him from time to time in Cambridge and Cope's fearful inaccuracy of citation and statement and his unscrupulous methods of acquiring material very unfortunately, in Garman's eyes, outweighed his undeniable genius and his utterly unrivalled, indeed uncanny, skill in working out relationship and building broad steps leading to our present systems of classification—systems based on natural relationship often hard to see. Cope saw.

Garman maintained his interest in the frilled shark for years and often talked of it and it was a pleasure, when I went to Japan in 1907, to bring him two eggs with good sized embryos attached which, by good fortune, I got from Alan Owston, the great zoological purveyor, before he died. Garman was delighted with these and figured the embryo in his monograph of the sharks, if my memory serves, for I am writing these lines in Florida.

All of this irrelevant verbiage is written for just one reason and that is to explain why, when I got Gudger and Smith's great memoir, I read it avidly from cover to cover. Here is the true story of this splendid and extraordinary creature, the whole story so far as that can be written today. Here is not only a complete, painstaking search for every atom of available information but a fair and generous presentation of the controversies to which various appraisals of its relationships, both with recent and fossil sharks, have given rise.

The whole material is well written, the illustrations are admirably chosen, the presentation is clear and fair—what more can one ask for. Ichthyologists owe the authors a debt of gratitude. They hope for more. How Garman would have devoured this great paper had he lived to see it appear.—T. BARBOUR, *Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.*

ALL ABOUT FISH AND OTHER DENIZENS OF THE SEAS AND RIVERS. By W. S. Berridge. New York, Robert M. McBride & Co., 8vo, cloth, 1933: 1-254, 126 figs. \$2.50.—Here is a fish book written from a human interest viewpoint; virtually devoid of dry systematic treatment and, despite its all-inclusive title, of much information that is not impressive; unweakened by efforts to avoid an anthropocentric viewpoint; unhampered by qualifying reservations, and unrestrained by the ogre of scientific accuracy. To be sure the author does insinuate a critical remark into the more obviously fantastic of the numerous recitations of English folk lore on fishes. The book was written by an Englishman for an English audience, for it deals in large measure with English fishes, along with the more curious or marvelous of the denizens of the seas and rivers or lands beyond the British Isles. Strange this seems, for we Americans have been told till we believe it, that our authors monopolize the sensational and under-rate their audiences.

"All About Fish" includes the information that certain goldfish ring a bell when asking to be fed, that the goldfish is but a domestic variety of the carp, that carp not infrequently lack teeth and are almost exclusively herbivorous; further that the stickleback produces its adhesive thread from its big mouth, but kills nest invaders by means of its fin spines; that fighting fish are Japanese, while the Chinese make their soup from the fins of the great white shark; that the fins of sharks are supported by spine-like rays, not apparent because concealed; that young toadfish adhere by their tails; that freshwater eels die before their offspring are hatched, though their eggs and larvae are unknown, and that these eels travel 6 or 7 months to reach their spawning grounds in the ocean depths; that the majority of fishes below the thousand fathom line are quite blind, though conditions of existence do not result in blindness because the Californian goby lives in ample light; that the roofs of American caves are phosphorescent and that blind fish occur in Switzerland (we have heard of the Swiss navy).

Just half of this book is all that the author required to tell "All About Fish," leaving the other half to treat "The Other Denizens of the Seas and Rivers," including "All About Sponges" in 10 pages and "All About Whales" in 16 pages. In the section on molluscs, he sympathetically recounts the proposed use of an anaesthetic to prevent hurting oysters when being opened, and confers a doctor's degree on Mikimoto-san, famed cultivator of artificial pearls.

In the chapter on "The Zoo's Aquarium" there is included some herpetological information. Amphibians mentioned include the Mississippi salamander or hellbender and the Surinam toad from the West Indies. Among the reptiles treated, the reader will hold in mind the sea snakes which are brilliantly colored to match the fronds of seaweed in which they lie in wait for their prey, and the gruesome anaconda which associates with angel fish and crushes collectors to death.

Amongst all this, the trained naturalist will distinguish a really large amount of truthful information, very interestingly presented, and illustrated by numerous photographs, some of which are very good. It is to be prayed that the author, in his *All About Birds*—announced as in preparation, has sought or will seek a critical reviewer in advance of publication, for his facile pen and his keen appreciation of the interesting will, I presume, make his books widely read.—CARL L. HUBBS, Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

EDITORIAL NOTES AND NEWS

New York Meeting

THE Seventeenth Annual Meeting of the American Society of Ichthyologists and Herpetologists will be held in New York City, from Thursday, May 10, to Saturday, May 12, 1934. Sessions will be held on Thursday and Friday, beginning at 9:30 A.M., at the American Museum of Natural History. The American Society of Mammalogists, and the American Association of Physical Anthropologists, will also hold their annual meetings at the Museum during the same week.

The Local Committee, consisting of Dr. E. W. Gudger (Chairman), Dr. R. L. Ditmars and Mr. C. M. Breder, is planning a series of demonstrations to supplement the scientific program. It is urgently requested that members bring to the meeting living or preserved specimens of particular interest, and developmental series, histological preparations, or other material which may illustrate some special point. All titles of papers to be presented at the meeting should be in the hands of Dr. Gudger (American Museum), not later than May 4th. The titles should be accompanied by a statement as to the time and projection apparatus required.

The Annual Dinner will be held at the Museum on Thursday, May 10th, at 7 P.M. An unusual program of motion pictures has been arranged for the evening. The New York Zoological Society has invited our members to be its guests at a Smoker to be held at the Aquarium on Friday evening, and has also invited our Society to make a tour of the Zoological Park on Saturday.

Headquarters will be at the Hotel New Yorker, Eighth Avenue and 34th Street, New York City, which is also the headquarters for the Mammalogists. The hotel has an entrance from the Pennsylvania Station and is directly connected with the Museum by the new Eighth Avenue Subway. The rates for single rooms range from \$3.00 per person per night up. All are outside rooms with bath and radio. Reservations should be made directly with the hotel management.

In subject-matter and in attendance, this meeting promises to be one of great interest.

Contributors to Anniversary Number

THE publication of the special Twentieth Anniversary Number of COPEIA, in a time of severe financial stress, was made possible by the generosity of the following members of the Society: Anonymous, Charles C. Adams, Harold L. Babcock, J. W. Bailey, Thomas Barbour, William Beebe, Sherman C. Bishop, Frank N. Blanchard, Rolf L. Bolin, C. M. Breder, Jr., Alvin R. Cahn, Robert T. Clausen, C. W. Coates, T. D. A. Cockerell, Stanton C. Crawford, C. Ralph De Sola, R. L. Ditmars, E. R. Dunn, H. T. Edwards, George C. Embury, F. E. Firth, W. F. Follett, Helen T. Gaige, Arthur M. Greenhall, William K. Gregory, E. W. Gudger, W. J. Hamilton, Jr., E. S. Hathaway, A. W. Henn, Carl L. Hubbs, L. Hussakof, David T. Jones, H. G. M. Jopson, Howard A. Kelly, W. C. Kendall, William B. Kirkham, L. M. Klauber, George F. Knowlton, Francesca LaMonte, C. C. Liu, G. P. Meade, Daniel Merriman, George S. Myers, A. L. Nelson, M. Graham Netting, Ross F. Nigrelli, G. K. Noble, A. I. Ortenburger, R. C. Osburn, R. M. Perkins, E. A. Preble, H. C. Raven, E. D. Reid, Jacob Reighard, J. H. Riley, Leo Shapovalov, J. O. Snyder, Leonard Stejneger, Homer W. Smith, F. H. Stoye, Milton B. Trautman, Francis J. Trembley, F. M. Uhler, Percy Viosca, Jr., Joseph H. Wales, E. L. Wickliff, A. H. Wright.

Royal Ontario Museum

THE Royal Ontario Museum, Toronto, officially reopened on October 12th, after undergoing renovation and extensive enlargements, now ranks among the large museums of the continent, for recent extensions have added 134,000 square feet to its floor space. It includes departments of Archaeology, Geology, Mineral-

ogy, Paleontology and Zoology. Each of these divisions in fact functions as a separate museum. The Museum of Zoology has 15,380 feet devoted to exhibits and 11,660 feet to the storage of research collections, laboratories, library and administration. The fishes of Canada are particularly well represented, both in the exhibit and the study series.

Expedition

THE second oceanographic expedition to Central American seas sponsored jointly by the Bingham Oceanographic Laboratory of Yale University and the Woods Hole Oceanographic Institution, has recently been completed. Prof. A. E. PARR, leader of the expedition, paid particular attention to the collection of hydrographic data, and to the study of the quantity, nature and origin of the floating sargasso-weeds. C. M. BREDER, JR., Assistant Director of the New York Aquarium, who accompanied the expedition as research associate of the Bingham Laboratory, reports that he met with success in his study of the flying fishes, and that he has brought back a fine collection of these fishes.

Monograph of the Plectognathi

A FRASER-BRUNNER, who recently published an excellent critical revision of the pomacanthine fishes (*Proc. Zool. Soc. London*, 1933: 543-599, fig. 1-29, pl. 1), is now at work, in the British Museum, on a world revision of the Plectognathi. In this research he is attempting to erect for these aberrant fishes a classification related to the evolutionary lines along which they have developed. He would welcome exchanges or loans of material.

News of the Ichthyologists

DR. JOHN R. GREELEY has resigned the Assistant Curatorship of Fishes in the Museum of Zoology, University of Michigan, to accept the position of Ichthyologist in the New York Conservation Commission. His place at Michigan has been taken by MILTON B. TRAUTMAN, formerly with the Ohio Division of Fish and Game. Mr. Trautman has also been appointed Assistant Director of the Institute for Fisheries Research, and will conduct investigations in both economic and systematic ichthyology. He will be in charge of the Fish Division and the Institute, while Dr. and Mrs. HUBBS spend the summer collecting fishes in isolated drainage systems of the West.

Dr. S. F. HILDEBRAND, senior ichthyologist of the U. S. Bureau of Fisheries, recently returned from Puerto Rico, where he conducted a survey of fish cultural possibilities of the island.

News of Fishery Biologists

DR. NEAL M. CARTER has left the staff of the Pacific Biological Station to assume the Directorship of the Fisheries Experimental station at Prince Rupert. During his three years at the Nanaimo Station he has undertaken and directed an intensive investigation of the oceanographical conditions in the Strait of Georgia, including a special study of conditions in various fiords.

Dr. LEWIS RADCLIFFE, former Deputy Commissioner of Fisheries, is now serving as executive secretary of the Oyster Growers and Dealers Association. The years of practical experience and the full knowledge that Dr. Radcliffe has of the fishing industry as a whole are proving of benefit to the Association.

Dr. A. H. WIEBE, formerly of the U. S. Bureau of Fisheries, is now on the staff of the Fish, Game and Oyster Commission of Texas. Dr. Wiebe is making limnological investigations on the lakes and rivers of Texas, as well as supervising the work at the state fish hatcheries.

The U. S. BUREAU OF FISHERIES is organizing parties for stream surveys this summer in the national parks and forests. These surveys, to be conducted on funds allotted by the Public Works Administration, will be under the general supervision of Dr. H. S. DAVIS, assisted by staff members Hazzard, Needham and Surber. The object is the formulation of a sound stocking policy, and of plans for the stream improvement work to be undertaken by the Forest Service. In all, it is announced, there will be placed in the field 15 parties of 4 to 7 men, including a trained biologist as leader.

The construction of the huge Bonneville dam on the Columbia River, one of the plays in the New Deal, casts a menacing shadow over the future of the vast salmon fishing industry of that river and of the West Coast from Monterey to Juneau. Fortunately the Public Works Administration, appreciating the seriousness of this problem, has made a grant of nearly \$10,000 to the Bureau of Fisheries for a study of the fishway requirements. HARLAN B. HOLMES of the Bureau's staff has been assigned this problem, which he will tackle with the aid of his fellow staff member ARNIE SUOMELA and of HENRY F. BLOOD, an eminent engineer of Portland.

A similarly happy cooperation between the engineering and the fisheries branches of the Government, involves the 9-foot channel project and the fisheries of the Upper Mississippi River. An appreciation of the threatened danger to the mussel and fish supply has led to a conference between Dr. MAX M. ELLIS, representing the Bureau of Fisheries, and Lt. Col. E. L. DALEY, representing the Army Engineers. As a result of this meeting, the fisheries interests will be considered in the damming and dredging of the river, so that so far as practicable fish movements may be permitted, pollution and silting alleviated, and the food production and the spawning grounds maintained.

Dr. FREDERICK A. DAVIDSON has been appointed Acting Director of the Bureau of Fisheries Biological Laboratory at Seattle, releasing JOSEPH A. CRAIG who is now devoting his time to researches on the sockeye salmon in Puget Sound. Mr. Davidson will continue his researches into the biology and conservation of the pink salmon. The Bureau of Fisheries announces as its policy that the scientific program of the staff at the Seattle laboratory so develop and become so adjusted to the practical needs of the fisheries in the States and in Alaska, that it will be a positive power for conservation in the entire region.

News of Herpetologists

HOUGHTON, Mifflin Company announce the publication of a revised edition of Dr. THOMAS BARBOUR's *Reptiles and Amphibians, Their Habits and Adaptations*. Recent word from Dr. Barbour, somewhere between Miami and Haiti, records fine reptile collecting on the Bahamas.

Dr. TRACY I. STORER of the University of California is spending the year in Europe, studying wild life administration and control.

GRACE OLIVE WILEY, formerly in charge of the museum in the Minneapolis Public Library, is now in charge of the reptiles in the new Chicago Zoological Garden.

Mr. and Mrs. GRAHAM NETTING have spent the last few weeks at the Laboratory on Barro Colorado Island, devoting particular attention to the habits of the amphibians.

Dr. A. H. WRIGHT and Mrs. WRIGHT are spending a sabbatical leave in the southern states, continuing their herpetological field studies.

Death of Dr. B. A. Bensley

PROFESSOR B. A. BENSLEY, head of the Department of Biology in the University of Toronto and Director of the Royal Ontario Museum of Zoology, died in Toronto on January 20 at the age of 58.

Dr. Bensley's contributions to ichthyology and to fisheries research in Canada were very considerable. He was for a number of years director of the biological work of the Georgian Bay Biological Station, which was maintained by the Dominion Government from 1901 till 1913. As a result of this work he published in 1915 *The Fishes of Georgian Bay*—one of the finest contributions to the ichthyology of the Great Lakes. In 1921 he organized within the Department of Biology, the Ontario Fisheries Research Laboratory, which has carried out numerous faunal and limnological studies in various Ontario lakes.

Many of the men holding important posts in fisheries research and related fields throughout Canada received their training in Dr. Bensley's department. He was a member of a committee appointed in 1928 by the government of Ontario to enquire into certain phases of the game-fish situation in Ontario, and to recommend measures of improvement. The comprehensive report of this committee, published in 1930, was largely the work of Dr. Bensley.

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